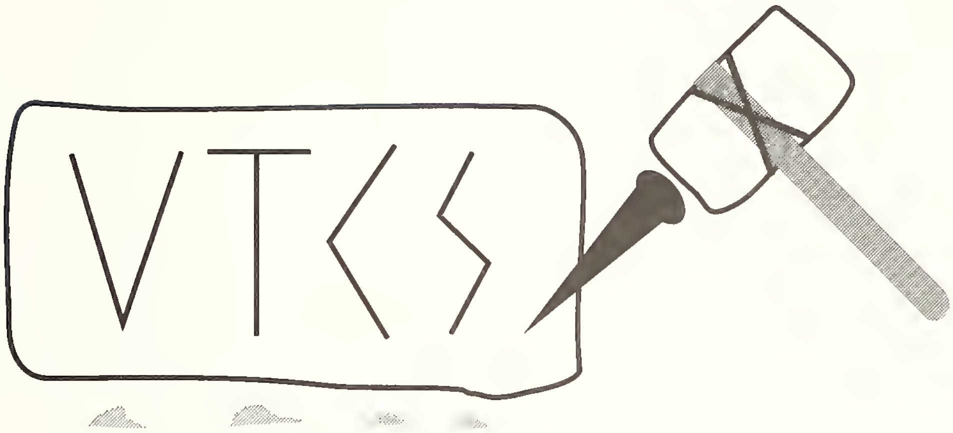
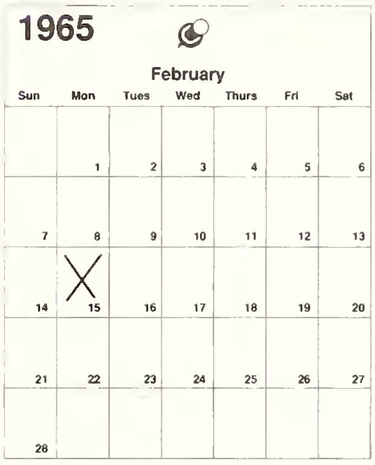
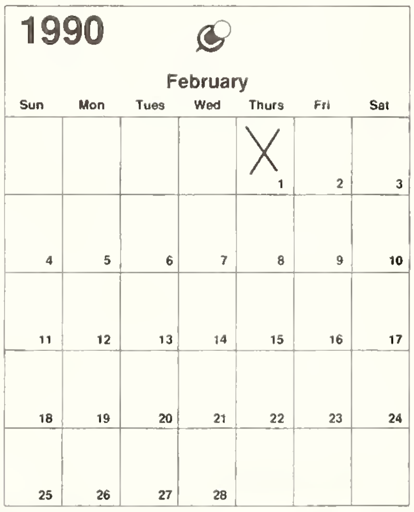
U18.2

university of toronto
computing services

ComputerNews







YEARS OF

ComputerNews

ISSN 0315-4661 January/February 1990 No. 260

Contents

Features

What are Computer Viruses? 1
Waiting for the EISA Bus 5
Impressions from COMDEX November '89 8
ARPP Macintosh Research Symposium 11
Scanning and Manipulating X-Rays with the Computer 11
Twenty-five Years of *ComputerNews* 15
Magnetic Tapes Available – Free 23
WordPerfect 5.1 – Taking Advantage of Educational Pricing 24
COREL DRAW 26

Statistical and Numerical Software News

SAS Data: Moving from Mainframe to Micro (and back) 28
New SAS Courses 31
ASYST and ASYSTANT – Data Acquisition and Analysis Software 32
Derive Keeps on Improving 34
MathStation – Technical Computing Environment for UNIX Machines 35
JMP Correction 36
New Microcomputer Courses 37
ComputerNews Changes 37
Microcomputer Short Courses 38
1989 *ComputerNews* Index 46

Departments

Documents at UTCS 39
Consulting and Enquiries 41
UTCS Directory 41
UTCS Terminal and Advising Sites 42
UTCS Services 43
Site Licenses at UTCS 44
UTCS Software List *will return next issue*

Acknowledgements:

Thanks to Easby Ho for her assistance in editing this issue.

Publisher
University of Toronto Computing Services
Toronto, Ontario
Canada M5S 1C1

Editor: Patricia Hood

Publications Assistant: Maureen Monné

Publication Date: *February 1, 1990*

Subscriptions
Subscriptions run for one year, beginning each January. Changes should be entered on the form at the back of this issue and mailed to *ComputerNews*, 4 Bancroft Avenue, Room 217 (or phone 416-978-4034). FAX: (416)978-7159.

ComputerNews is published eight times yearly by the University of Toronto Computing Services (UTCS). Enquiries should be directed to:

The Editor
ComputerNews
University of Toronto Computing Services
4 Bancroft Avenue, Room 217
Toronto, Ontario
Canada M5S 1A1

Network address:
phood@vm.utcs.utoronto.ca
(NetNorth/BITNET/EARN)

Unless otherwise indicated, network addresses appearing after the author's name pertain to NetNorth/BITNET/EARN.

Permission is granted to reprint articles from *ComputerNews* for noncommercial purposes provided the author, publication, and issue are acknowledged.

IBM PC, PC-XT, PC-AT, Personal System/2, Operating System/2 are trademarks of IBM.
LaserWriter is a registered trademark of Apple Computer.
Lotus 1-2-3 is a registered trademark of Lotus Corporation.
Macintosh 512K, Plus, SE are trademarks of Apple Computer.
Microsoft Word is a trademark of Microsoft Corporation.
PostScript is a registered trademark of Adobe Systems Inc.
SAS is a trademark of SAS Institute Inc., Cary, N.C.
SPSS^x is a trademark of SPSS Inc.
UNIX is a trademark of AT & T Laboratories.

This newsletter was entirely produced on a Macintosh using PageMaker and other related Macintosh software.

What are Computer Viruses?

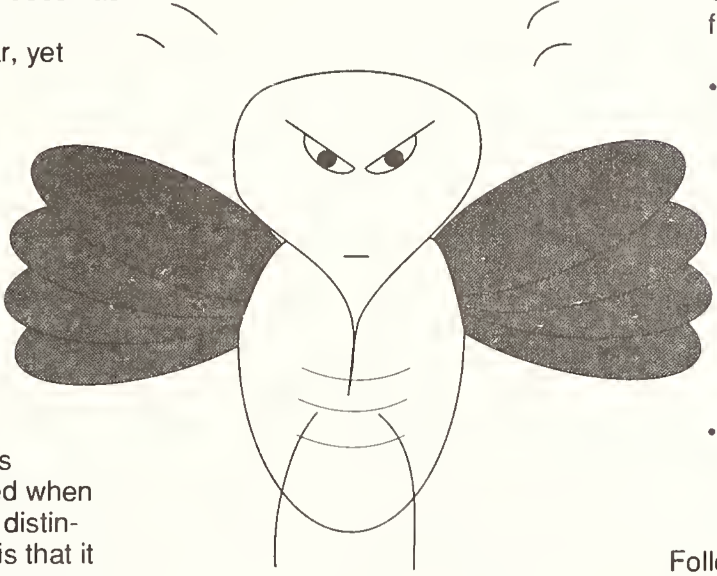
Jon Alexander
jon@utcs.utoronto.ca

Adam Iles
adam@gpu.utcs.utoronto.ca

The subject of computer viruses has been given a great deal of attention over the past year, yet many people still do not understand what a computer virus is. This article is intended to give you a better idea of what computer viruses are and how you can deal with them.

A computer virus is a piece of program code which attaches itself to another program, so that its instructions will be executed when that program is used. The distinguishing feature of a virus is that it propagates from one computer to another, like a biological virus, by users sharing infected programs. A virus may contain a "logic bomb," a piece of program code that will activate another program code and damage the information on the host computer. Typical logic bombs check the specific date (such as the Friday 13th virus) or the number of times that an infected program has been run.

Viruses are often confused with "Trojan horses," which are another form of destructive program. The main difference between a virus and a Trojan horse is that the Trojan horse is a self-contained program which appears innocuous, but actually includes program code of a destructive nature. It relies on people to share copies, whereas a virus actively attempts to replicate itself. Both viruses and Trojan horses often contain logic bombs, so that their detection will be delayed until they have had a chance to spread to other computer systems.



Virus Prevention

To date, more resources have been spent trying to detect and to eliminate viruses than to recover from virus attacks. The recent "Friday the 13th" scare used up more resources and time prior to the 13th than after that date when the virus had been triggered. Despite the limited damage caused by viruses to date, computer users should be vigilant against infections, since they do pose a real threat and can destroy the data on your computer. Nearly all computer viral infections can be prevented by practising safe computing.

Safe computing can be summed up by a few simple rules.

- Maintain a complete backup of any irreplaceable data on your disk.
- Use only software which comes from a known, reliable source.
- Keep all virus detection programs current.
- Test any new programs for viruses BEFORE you use them.
- Back up any important data before running any new programs.
- Write protect any diskettes that you do not want to be written on.

Following these rules will minimize the chances of having your computer system infected by a computer virus. In any case, these rules will also help prevent data loss not related to a virus.

Macintosh Viruses

Mac applications are stored on a computer disk in two "forks": the data fork and the resource fork. In the case of a program, the data fork generally contains data that the program needs to operate. The "resource" fork contains pieces of code and other items, such as icons and file information, that make up the application. Each part of the code is stored separately within the resource fork. Data files follow a similar structure, but often have nothing in their resource fork except for an icon and information about the application that created them.

Because Macintosh files tend to follow this pattern almost universally, it is easy to design "virus" programs that add or modify resources within the resource fork. Such viruses are program codes that take control during an application's operation and then spread themselves to other applications.

Most viruses tend to spread by re-creating copies of themselves in the resource fork of another file, usually an application. They spread from an infected application, usually one on a floppy diskette or one loaded onto your hard disk through a modem. In some cases, viruses have been known to infect a special hidden file, the "Desktop" file that is part of the Macintosh operating system.

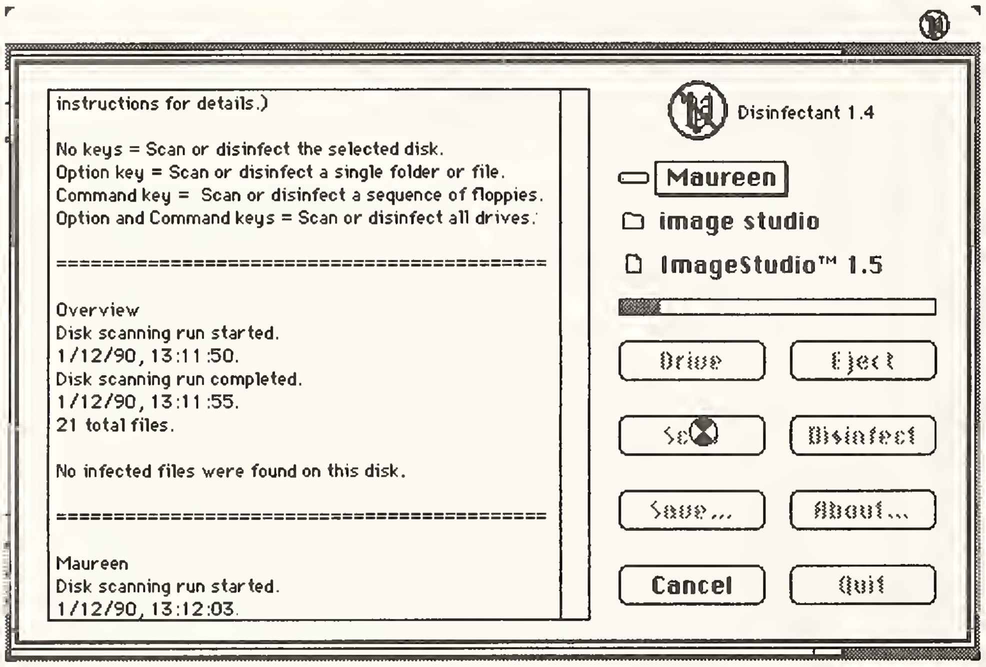
Not all viruses are designed to be harmful. Often, they are only meant to do additional things, such as causing the system beep to sound randomly or putting a message window on the screen. Unfortunately, some of these viruses have serious side-effects, causing certain models of the Macintosh to crash or causing interference with printing.

A Typical Macintosh Virus: nVIR

"nVIR" is a virus which infects applications on the Macintosh by adding a resource called "nVIR" to the resource fork of a Mac application. The nVIR resource contains code that spreads itself from its host application to others. It usually infects the System application first, then spreads itself to other applications on the same disk. The nVIR virus contains specific code that causes the Mac to sound its system beep at random intervals (actually defined by a simple formula). It can be detected by virus-detection tools available at UTCS, and is best eliminated by replacing infected files with virus-free copies.

MS-DOS (IBM PCs and compatibles) Viruses

Compared to the Macintosh environment, MS-DOS programs access the computer on a lower level. In other words, a program running under MS-DOS will access the hardware directly, whereas the program on a Macintosh must access the computer hardware by using the operating system. MS-DOS programs are not divided into resources, but are



```
instructions for details.)

No keys = Scan or disinfect the selected disk.
Option key = Scan or disinfect a single folder or file.
Command key =  Scan or disinfect a sequence of floppies.
Option and Command keys = Scan or disinfect all drives.

=============================================

Overview
Disk scanning run started.
1/12/90, 13:11:50.
Disk scanning run completed.
1/12/90, 13:11:55.
21 total files.

No infected files were found on this disk.

=============================================

Maureen
Disk scanning run started.
1/12/90, 13:12:03.
```

Screen capture of Disinfectant scanning a hard drive's files for viruses. While scanning is in progress, icons and names of the drive's applications, files and folders flash by, while the beachball icon spins.

contained in one contiguous piece of code. As a result, MS-DOS viruses have more targets to infect and can even work their way around software virus protection.

Viruses are often described by the method with which they used to infect a system. COM and EXE infectors are viruses which attach themselves to program files with an extension of .COM or .EXE. Boot-sector viruses will copy themselves onto the boot-sector of a disk, which is where the computer instructions to load the rest of the operating system are stored.

MS-DOS viruses will load themselves into the memory of the computer either when it is booted or when an infected program is run. Once a virus is loaded into the computer, it may attempt to propagate and/or damage the information on the host computer. The damage that a virus may attempt ranges from increasing the size of your programs to reformatting your entire hard disk. Once the virus' destructive phase has started, the best thing to do is to revert to a backup of the infected files. Even when you have restored the information, it is important to check your system for remaining viruses, which may have been copied while you were backing up your disk.

Even if backups are not available, the data may still be partially or completely recoverable. Success in recovering data often depends on attempting the recovery BEFORE writing anything onto the disk. Utility packages, such as **Norton Utilities** or **PC-Tools,** provide further protection by saving a second copy of the organization of your disk. Even with the chance of recovering the lost data, the only reliable method is to maintain complete backups, which also protect your data from a hardware failure.

Glossary

logic bomb - A computer program designed to have a specific effect (to "go off") when a certain operation occurs or when a specific action is taken. Often, its intended effect is malicious, such as destroying data or computer disk information (needed to access data on the disk). The logic bomb can be spread as a virus, a worm, or a trojan horse.

virus - A term for a computer program that spreads itself like a biological virus, putting parts of itself inside other programs or in hidden parts of a computer disk, with each part having the ability to spread itself again.

trojan horse - A program designed to be concealed inside or look like an innocent program, but intended to have a specific effect (e.g. a logic bomb, or a more benign warning message).

worm - A type of virus that is designed to spread itself from computer to computer, often over a network or through some other means, without the need for human assistance. A worm is often designed to spread over networks by automatically looking up the address or location of adjacent machines on the network and exploiting some weakness in a particular system to gain access to those machines.

A tale of two viruses: the Stoned and the Datacrime viruses

The "Stoned" virus does not attack the program files on your disk, but infests the partition table of a hard disk or the boot sector of a floppy diskette. These are the areas of the disk which are first read when the computer is booted. This virus spreads by sharing diskettes rather than by sharing programs.

The Stoned virus is reportedly written by a high-school student in New Zealand. The virus has several bugs in its programming, which causes it to corrupt disks when they are infected. This is a good example of a virus that causes damage without intending to do so.

Probably the most infamous virus is the "Datacrime," or "Friday the 13th," virus which dominated the headlines in early October 1989. The Datacrime virus infects program files on MS-DOS systems and spreads when these programs are shared. The Datacrime virus includes a logic bomb that is activated by running an infected program on or after Friday, October 13. The logic bomb attempts to destroy the part of the hard disk that holds the information on how its files are organized. It is often possible to recover some of the data when this happens, but if precautionary steps have not been taken, the amount of work is greatly increased and the likelihood of recovery is diminished.

How UTCS can help

If your computer has been infected or you suspect that it may have been, you can contact the UTCS Advising Office for assistance. We distribute several public domain and shareware virus detection programs for both the Macintosh and the MS-DOS environments. Not only will these packages help determine whether your computer has been infected, but they will also identify the virus for you.

Once the virus has been identified, we can assist you in eradicating it. This may involve recovering programs which were infected or reformatting your hard disk. If you do not have backups, then we can help you try to recover files, although the success rate for such recovery is much lower than recovery from backups.

To obtain virus detection tools, bring a blank floppy disk (3.5" or 5.25") to the UTCS Advising Office, located at 4 Bancroft Avenue, Room 201. We are open between 10 a.m. and 6 p.m., Monday through Friday. The Advising Office can also be reached by telephone at 978-HELP.

Please note: The tools that UTCS distributes are either public domain or shareware software. Shareware is freely distributable, but the recipients are obliged to send remuneration to the author if they use the software. People who find these tools useful are expected to honour the agreements

PC Anti-Virus Tools

ViruScan is a program that will examine disk files for known viruses. Because this program does not remain in the computer's memory, it will not interfere with the operation of other programs. ViruScan is constantly updated as new viruses are being discovered.

ScanRes is a current version of ViruScan that does remain in the memory of the computer and waits for a program infected with a known virus to be loaded. When a virus is found, you are notified. Because **ScanRes** remains in the computer's memory, you do not have to explicitly check every program before running it. Since **ScanRes** is looking for known viruses only, you will need to maintain an up-to-date version to protect your computer from new viruses.

Mac Anti-Virus Tools

Disinfectant is a program for detecting viruses. Though it can also be used to eradicate viruses, UTCS recommends that infected files be discarded and replaced by virus-free backups whenever possible.

Vaccine is a program that runs as soon as the Macintosh is started, specifically to prevent any file modification activity that might be the work of a virus. It can be configured in the "Control Panel" desk accessory and has several options for you to control its activity.

Waiting for the EISA Bus

David Sutherland
davids@gpu.utcs.utoronto.ca

After almost a decade of compliance with an informal standard based on imitating the original IBM PC and AT, industry and consumers find themselves in a small revolution. This change has been brought about mainly by the tremendous increase in the computing power that the 80386 and 80486 central processing unit (CPU) chips make possible. One of the major changes has been the emergence of competing "bus" standards.

What *is* a Bus?

For the average computer user, the bus is the place where the memory, video display, and disk controller adapter cards are plugged into the computer. The bus is needed to successfully integrate the adapter cards.

The bus is a hardware component, consisting of wires and connectors, that allows the various parts of the computer to communicate with each other. For each bus, there is a set of rules that governs how an adapter card, such as a disk controller, can communicate with the CPU of the computer or to another adapter card. Of course, many things need to be standardized:

- the size and shape of the connector used to attach the adapter card to the main board of the computer,
- the maximum amount of power the card can draw,
- the length of time that the bus can be used and the speed at which the bus operates,
- the rules that govern how the adapter cards will share the bus.

The system of adapter cards provides tremendous flexibility. As an example, consider two people who each purchased identical 80286 clones a year ago.

Martin now finds his work is primarily concerned with writing and desktop-publishing (DTP). To accommodate this, he replaces his Hercules display adapter with a high resolution monochrome adapter designed specifically for DTP applications like PageMaker and Ventura.

Helen has developed a large database that she uses constantly. To improve the performance of her computer, she replaces the existing ST-506 type controller and hard disk with a high performance Enchanced Small Device Interface (ESDI) controller and 150 megabyte (MB) hard disk.

Because of the bus, each user can select the configuration that best meets his or her needs.

Originally, the IBM AT computer used a 16-bit bus that has become known as Industry Standard Architecture (ISA). With the release of the PS/2 machines in 1987, IBM replaced the ISA bus with the Micro Channel Architecture (MCA) bus, a highspeed 16/32-bit bus. Other PC-compatible manufacturers are supporting the Extended Industry Standard Architecture (EISA) bus which is a highspeed 32-bit bus. Both Compaq (Deskpro 486/25 & Systempro) and Hewlett-Packard (Vectra 486) recently introduced their first EISA-bus products.

Why ISA Has Run Out of Steam

Though the ISA bus is "open architecture" and offers tremendous flexibility, the design of the ISA bus does not have the capacity to provide the services that the new high-powered CPUs need.

While the current generation of 80386 CPUs run at between 16 and 33 Megahertz (MHz), the ISA bus is limited to a maximum speed of 8 MHz. The 80386 and 80486 CPUs are designed to accept data in 32-bit chunks, but the ISA bus can provide only 8-bit and 16-bit chunks. Because of these limitations of the ISA bus, the full power of the new CPU chips cannot be utilized in machines using it. In order to provide maximum performance, designers had to develop new bus standards.

IBM Proposes MCA

IBM was first to respond to this challenge by introducing the Micro Channel Architecture (MCA) bus. IBM's goal was to provide a standard that would accommodate upgrades in technology for the next 20 years. With such a long-term goal, it was not considered important for the bus to work with the current generation of AT-class machines. As a result, when the MCA-based machines were first introduced, third-party adapter boards were scarce. For commercial reasons, IBM chose to license their technology for the MCA bus in a way that was not attractive to its competitors in the PC business. Consequently, other PC-compatible manufacturers did not follow IBM's lead and develop MCA-based machines.

The Competition Responds Once

In an effort to better IBM, each manufacturer developed its own proprietary 32-bit bus. These proprietary buses were normally used for memory. They also kept the original PC/AT-compatible bus slots, permitting the use of existing ISA adapters. Machines following this approach consistently equalled or bettered the performance of MCA-based machines using MS-DOS applications. In addition, there was more variety in the selection of adapter cards. However, these machines suffered from a big problem, primarily the proprietary 32-bit bus that each manufacturer developed. Each manufacturer sold their own 32-bit memory board (at their own price). No single manufacturer had enough of a market share to encourage development of third-party adapter cards for graphics, communications, or disk storage. Once you bought their bus, you were committed to their brand of products. Furthermore, these machines were still limited to the ISA bus. This meant that graphic applications actually had to slow down to draw anything on the screen. The ISA bus limited information access to the hard disk to 16 bits at a time, rather than the full 32 bits. As a result, the full potential of the new chips could not be exploited.

The Competition Responds Again

Recognizing the need for an industry-wide, high-performance bus, a group of nine manufacturers formed a consortium to develop specifications for a bus that would provide highspeed access to 32-bit adapter cards, while continuing to support the use of ISA adapter cards. This new bus was called Extended Industry Standard Architecture (EISA).

Will EISA return us to the golden age of ISA's open access but with “warp speed” performance? Let's look at some early offerings.

The Compaq Deskpro 486/25

Compaq introduced two EISA machines this fall: the Deskpro 486/25 and the Systempro. We will take a closer look at the Deskpro 486/25. This machine uses both an EISA bus and Compaq's Flexible Advanced Systems Architecture (FLEX) with a proprietary 32-bit bus.

A single FLEX bus slot is used to connect the CPU with the memory controller, highspeed memory cache, and system memory. A single FLEX bus memory card allows you to install up to 100 MB of memory in the computer. This custom bus has allowed Compaq to design an external memory cache that improves on the performance of the cache inside the 80486 CPU. The result is that an average of 95-98% of memory reads are found without any wait states. Unfortunately, the memory expansion modules are custom to Compaq; industry standard Single In-line Memory Modules (SIMMs) cannot be used to upgrade the machine.

The Deskpro 486/25 has eight EISA bus slots. The standard configuration comes with a conventional AT-type ESDI hard disk control. Compaq also offers an optional 32-bit Intelligent Drive Array (IDA) controller that takes advantage of the EISA bus.

The Advanced Graphics 1024 board is a high-resolution Video Graphic Adapter (VGA) compatible adapter card. The card uses a TI 34010 graphics co-processor to speed up the drawing of graphics, but is limited to the 16-bit ISA bus standard.

In addition, the Deskpro 486/25 continues Compaq's tradition of innovation within the limits of existing industry standards. With the exception of the proprietary memory system, the machine can take advantage of both the existing ISA adapters and the coming EISA products.

The HP Vectra 486

As its name implies, the HP Vectra 486 uses the 80486 CPU. The CPU is contained on its own separate card and plugs into the motherboard (main board) of a proprietary highspeed host bus. Also sharing this bus is the system memory adapter card with up to 64 MB of memory. HP offers a high-performance VGA card that plugs into the third highspeed host bus connector. This bus operates at the clock rate of the 80486 CPU and is not directly subject to the rules that govern the EISA bus.

The highspeed host bus connects to eight EISA connectors and a local input/output (I/O) bus through two EISA controller chips. The EISA controllers act as traffic officers controlling the flow of information between the EISA adapter cards, the local I/O bus, and the CPU.

The use of the local I/O bus is particularly interesting. The unit's keyboard, mouse, and real-time clock are all located here. So are the floppy-disk controller, the serial and parallel ports, and connections for hard disks with embedded ESDI controllers (limited to under 300 MB). The facilities on the local bus are so complete that it is possible to run the machine without any EISA or ISA adapters installed. But users who need larger-capacity drives will have to select an ISA-class controller or wait for an EISA controller to become available. Machines of this capacity are frequently used as file servers or multiuser hosts. Both these applications would benefit from the increased performance of EISA communications adapters.

EISA Not as Open as We Thought

Clearly the Vectra and the Deskpro each demonstrate their corporate pedigrees. Compaq made its reputation based on reliable business machines and Hewlett-Packard is famous for scientific and engineering equipment. These machines also demonstrate that neither manufacturer considers the EISA bus adequate for expanding system memory.

The Deskpro is a more conservative design with respect to the video display. As standards emerge, we presume that the existing VGA adapter will be replaced by a more recent 32-bit EISA device. Currently, the EISA bus is used to advantage by the IDA and this machine will likely find application as a database server on a network or as a multiuser UNIX host.

The Vectra will be of interest to people using the computer for engineering tasks such as Computer-Aided Design (CAD) or modelling and simulation, or to computer artists who need high-quality graphics for desktop presentation and publishing applications. The compromise for this improved performance is that you must use Vectra's particular proprietary display system. At this time, it remains unclear how video display will be supported in the future.

If you are buying a machine today, which bus should you choose? EISA machines are going to command premium prices. IBM, in contrast, offers a very attractive educational discount on their MCA-based machines, through the University of Toronto Computer Shop. Still, the budget-conscious will get the the best dollar-performance ratio with a computer using a combination of a proprietary 32-bit bus and the ISA bus.

Impressions from COMDEX November '89

Martha Parrott
parrott@vm.utcs.utoronto.ca

COMDEX is the little computer show that grew. And Grew. AND GREW. Last November's COMDEX attracted 120,000 people. Some of us actually walked down all of the 21 miles of aisles set up in the Las Vegas Convention Center and various surrounding hotels. Here is an abridged account of what I saw.

The 486 Machines

By the second or third day, the COMDEX daily paper had declared that the most exciting news was in laptops and the 486 machines. Certainly there were many 486 machines, most shown running either benchmark tests or some complicated, ever-changing graphics display. They were all, well, fast. Some were for desktops; some were towers; all were beige.

A few of the higher-profile vendors had unveiled their 486 models earlier in the fall, but Intel's i486 chip, on which the machines are based, was found to have a flaw in the way it handles floating-point calculations. Most of the vendors at COMDEX said they would be shipping "in January," since the corrected chips would not be available until "the end of the year." It may be that by the time you read this, the stores will be full of 486 machines. But don't count on it. Even if the chip is ready as promised, it may not be available in sufficient quantities by then.

A few companies decided to ship anyway, since the bug in the chip is too specialized to affect many applications. Intel has promised to replace the chips in those machines when the corrected one is ready.

Laptops

Laptops are growing in popularity and shrinking in size and weight. Several are now small enough to fit in a briefcase, and are referred to as "notebook sized". A popular advertising gimmick was to have a brochure of the same length and width as the computer. (I saw no computer that was paper thin; maybe next year!) One reason for this shrinkage is the introduction of the 1/3-height (i.e., one inch) disk drive. Some vendors are also putting DOS in Read-Only Memory (ROM), allowing you to get by with one floppy drive and no hard disk. (Updating DOS then becomes a concern.) Another notebook portable uses an entirely different and (to me at least) truly exciting technology (see "Neat Stuff," page 10).

Smaller than the notebook-sized are the pocket-sized computers. Instead of internal disk drives they use solid-state, battery-powered memory cards, about the size of a credit card. The keyboards, however, are barely large enough to accommodate a touch typist, and one had a very odd tilt. By the way, pocket-sized apparently means "man's inside coat pocket, sometimes, but not always." I saw one that fit into the salesman's coat pocket, but not into that of another man in the assembled crowd.

EISA vs MCA

One of the hot topics, even before COMDEX, was the battle of the MCA (IBM's Micro Channel Architecture) machines and the EISA (Extended Industry Standard Architecture, from the so-called Gang of Nine) machines. Some less well-known vendors have lined up on one side of the fence or the other, while others are waiting to see which side grows the greener grass. Still others were at least planning to graze on both sides. My impression is that I saw more EISA signs than MCA signs, but quantity doesn't necessarily outweigh the influence of IBM. Clearly, only time and the wisdom of consumers will determine the outcome. For some history and a discussion of the significance of EISA and MCA, see David Sutherland's article on page 5 in this issue.

OS/2's Future Secured (probably)

The future of OS/2 was another popular topic. The push for OS/2 was highly organized: everyone who registered for COMDEX was given a white plastic shopping bag emblazoned with a red OS/2, and snack bars dispensed soft drinks in cups labelled OS/2. The latter may have been a slight marketing error, since there was ample opportunity for cynical photographers to get shots of OS/2 in the garbage (which they did). Actually, there were quite a lot of products of all kinds that either supported OS/2 or promised to do so in the future. In any case, the debate finally sputtered to an end at midweek, when IBM and Microsoft issued a joint announcement that any future Microsoft products and upgrades would be developed for OS/2 first. With Microsoft's many eggs in the OS/2 basket, concern about a dearth of software for OS/2 should wane. (IBM has been justly criticized for poor publicity around this announcement. There was no warning of the announcement, and the company hid the copies of the press release in its own press office instead of placing them in the official press room where reporters might actually have found them. For at least twenty-four hours, the "announcement" was more like a semi-organized rumour. Most of the people in the IBM booth didn't even know about it.)

Networks

Products for networks, both LANs (Local Area Networks) and WANs (Wide Area Networks), were a common sight this year. On the hardware side, there were some new technologies to allow essentially wireless networks. Lasers and spread-spectrum radio transmission look interesting and may turn out to be alternatives in cases where cabling costs would exceed the cost of these new media. Another product uses existing electrical wiring to transmit data, though it has some real limitations in speed and distance.

As for software, more and more packages are becoming available for group use on networks (such products are sometimes actually called groupware). Of course, many of the major software packages already had multiuser versions, but new packages are also appearing that are designed primarily for use across networks connecting all kinds of machines and environments. See the next section for more on this.

Trends

One of the most important trends, in my opinion, is the growing interest in "interoperability," i.e., making everything talk to everything else (a far cry from not so many years ago when the industry objective appeared to be maintaining proprietary interests above all else). This has been going on for a while, but it was particularly striking at a show like this, where you can at least hope to get a feel for where the computer industry is headed. SQL database servers are an important example, though not quite as good as they should be, perhaps (see below).

SQL (Structured Query Language) is a relational database product and query language developed by IBM in the 1970s. It has long been supported by such IBM mainframe databases as DB2. SQL's query syntax has become a standard, but it is not so easy to learn as it might be. An SQL database server resides on a networked machine and functions much as a mainframe database does for multiple users. The difference is that it allows you to use the microcomputer environment and database software you already know as a front end; you don't actually have to learn anything about SQL to access a database, whether it's on the server machine or on some other kind of machine attached to your network.

Several SQL servers are available now, but they still have some limitations. They may work only with certain LAN software, though most server developers are planning to expand their products' compatibility in this respect as quickly as possible. Servers are also limited by the number of front-end environments and database packages that have been adapted to work with them, though the major applications packages, such as dBASE, seem to work with all.

What some people find unfortunate about the SQL server situation, however, is that there is no underlying standard for the servers. Each has, to some extent, its own approach. Vendors at COMDEX would say only that the market would eventually shake down to two or three standards and they were confident, of course, that their product would be one of them.

Besides the SQL servers, there are other signs of a trend toward software interaction. An increasing number of packages seem to have some kind of two-way linking with other packages; these are often termed "warm" or "hot links." You can import data from a spreadsheet into a database, for example. That in itself is not new, but now you can also maintain the link between the two copies of the data—when it is updated in the spreadsheet, the copy in the database is automatically updated, and vice versa. Another package I saw can collect information from databases and spreadsheets on machines all over a network, combine the data as required in the package's own information display, and maintain hot links wherever necessary to ensure that everything is kept up to date.

More than Just the FAX

FAX machines are popping up all over campus, so I kept an eye out for developments in that area. Several products are available for putting a FAX machine on a network. Another new FAX machine now connects to some HP laser printers, so that the copy is printed on regular paper instead of the noisome thermal paper that afflicts most FAX machines. I also saw a FAX card that actually goes inside an HP laser printer.

Neat Stuff

A new technology in permanent storage is starting to make itself felt: non-volatile, solid-state memory chips that are erasable by electricity rather than ultraviolet light. The technical term for these is EEPROM (Electrically Erasable Programmable Read Only Memory), but they are also called flash EPROMs—flash is the word to remember. Right now, flash memory comes on a full-length expansion card that can serve as an extra hard disk drive in your PC, and at least one laptop is already using flash memory in matchbook-sized, solid-state disks (SSD). There are some dangers associated with this kind of storage. When you delete, for example, there's no second chance; that data is gone forever. Also, I am not clear on the effect of static electricity on such a disk. However, these developments do suggest some big changes only a few years down the road. Once any problems have been sorted out (and of course they will be), this kind of storage is expected to replace mechanical disk drives. Intel, which makes the chips, estimates that the cost curve for this kind of memory will intersect with that of conventional disks in about four years. What does this mean? There may no longer be short-term (RAM) and long-term (disks) memory; there may be just memory. No need to save a document before you turn off your machine—it will be there as you left it when you power on again. No need to index a database—data can be found as quickly as it could if it were in RAM.

Another product that I found exciting was a laptop without a conventional monitor. Instead, it has a headset that holds a small unit in front of your eye, wherever you look. A hologram-like image that looks like a screen “floats” in front of you. If you wear glasses, you may choose to use them or not, since the focal point can be adjusted. Sounds weird? I tried this out and, once you get used to the idea, it works very well. Right now, this equipment comes only with the vendor's own laptop, but they are preparing a headset that will work with other machines.

All we have to do now is get rid of the keyboards. Unfortunately, voice recognition and artificial intelligence haven't gotten that far yet. There is a product that lets you verbally enter the formatting commands of some major PC wordprocessors, but you still have to type or scan the actual text.

For more information on any of the products mentioned in this article, call Martha Parrott at 978-5071.

ARPP Macintosh Research Symposium

Fraser Shein
shein@gpu.utcs.utoronto.ca

In late April 1990, the Apple Research Partnership Program (ARPP) will be sponsoring a one-day symposium about the application of Macintosh computers in current research at the University of Toronto. Researchers are being invited to give short presentations in which they will demonstrate their developments and discuss how the technology is being utilized within the context of their own projects.

This symposium will show researchers how others at the University are taking advantage of the Macintosh. It will also be an opportunity for them to find out how the latest tools that are available for the Macintosh may benefit their work.

If you are currently using the Macintosh in your research and would like to share your work with others, please contact ARPP at 978-7828. Information regarding specific presentations and registration details will be made available in the next issue of *ComputerNews*.

Scanning and Manipulating X-Rays with the Computer

Jennifer Boldt

Eddy Wong
ewong@gpu.utcs.utoronto.ca

In the field of health care, medical and technological advances have brought about significant improvements in treating patients. Computers have proven to be of invaluable assistance in conducting research, storing patient records, and keeping accounts. Recently, developments in computer graphics technology have made possible a new way of storing images created by the x-ray process.

Radiology is a visual field in which a diagnosis is made by comparing x-ray images. When several images showing similar abnormalities have been located, the diagnosis can be confirmed. Presently, radiologists who work in smaller or outlying hospitals encounter difficulties in making comparative diagnoses because they simply do not have a wide variety of records on file. In larger hospitals, where the information *is* available, it is often hard to find previous cases to support a diagnosis because they are not indexed or stored in a way that makes the information easy to retrieve. Thus, radiologists are interested in having access to a comprehensive database of easily-accessible records.

As the result of several inquiries, the Apple Research Partnership Program (ARPP) consultants experimented with scanning x-rays and importing the resulting files into various image-enhancement programs as the first step toward establishing an x-ray database.

Locating Hardware

Most hospitals and universities have an Apple scanner or an equivalent product. These 4-bit scanners can scan and store images using only sixteen levels of grey, which doesn't provide enough image resolution to allow proper manipulation of the image in image-processing packages. However, if all that is required is a rough image for use in a HyperCard stack, for example, scans done on the Apple scanner are suitable.

Abaton has introduced an expansion card for the Apple scanner, which upgrades it from a 4-bit to an 8-bit scanner. An 8-bit scanner can scan and store 256 levels of grey. Like many 8-bit scanners, the upgraded Apple scanner may require an additional attachment, such as a mirror, to enable it to scan x-rays and transparancies. Since the upgraded Apple scanner is still in the developmental stages, it will be a while before we will find out the quality of the x-ray scans it produces.

The ideal scanner would be an 8-bit scanner that could accommodate x-rays of any size. Unfortunately, we were unable to find one. (An actual x-ray scanner, the Truvel, does exist, but the only one we could locate was in Buffalo.) The scanner we finally tested is the Sharpe JX 450, an 8-bit colour scanner that can handle original images up to 8" x 10". To enable it to scan x-rays and transparencies, it requires a mirror attachment. The physical size of the

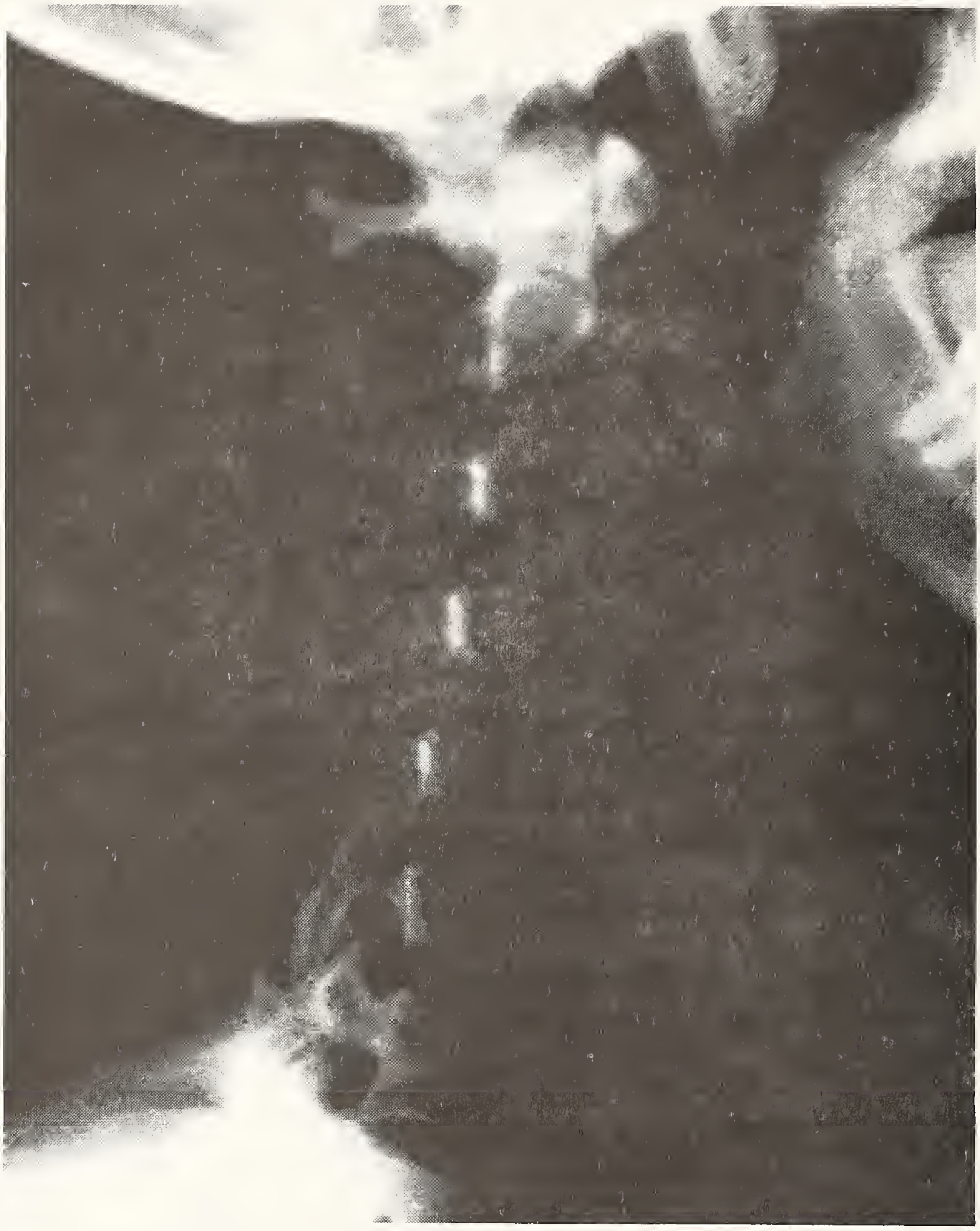


Figure 1

scanned area is limited by the placement of the white balance bar within the edge of the scanplate. (The white balance bar allows the colour scanner to handle black and white images.) We created a scan at 300 dots per inch with 256 grey scales, which produced a clear, crisp image that could be manipulated.

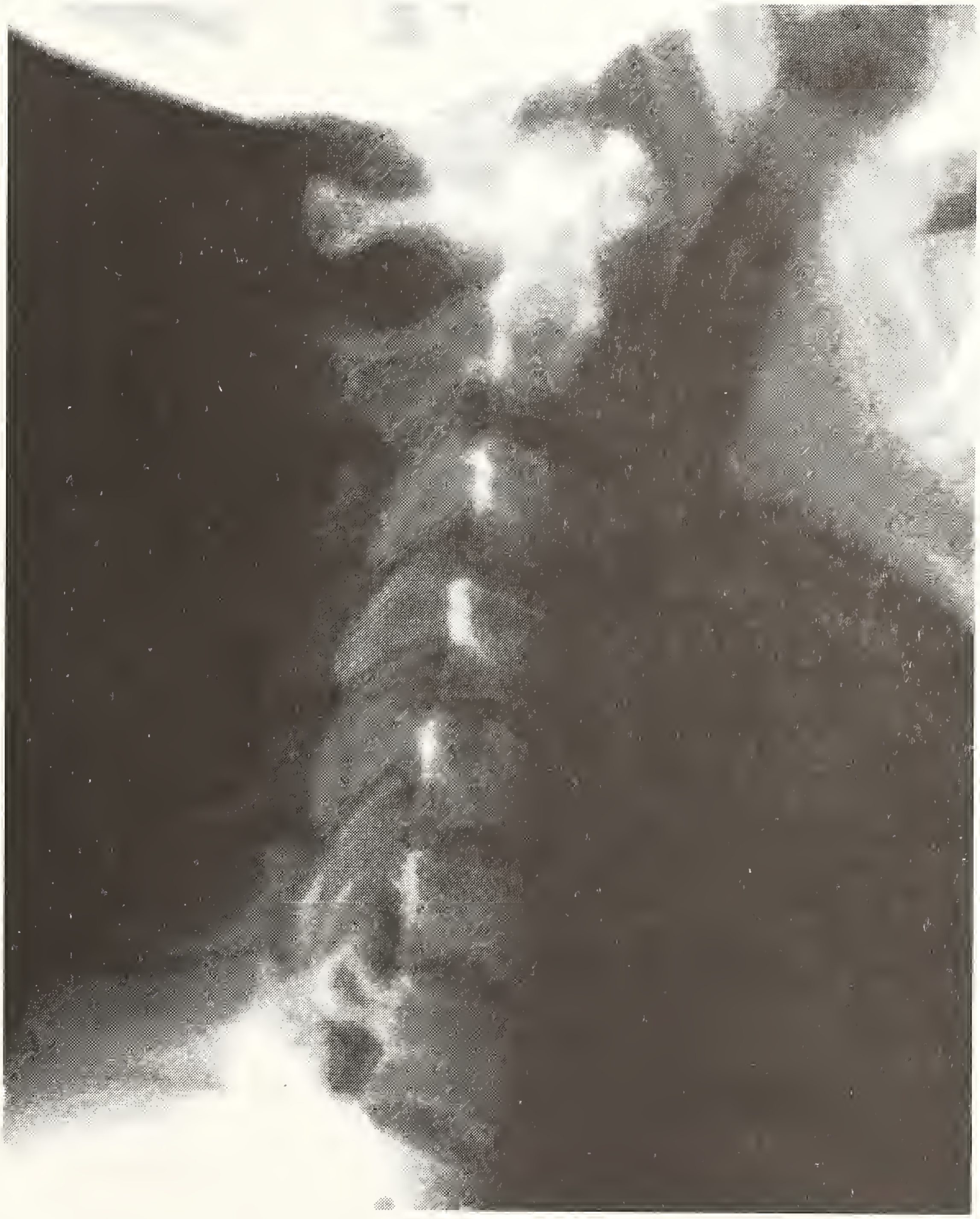


Figure 2

Testing Software

For organizing and analyzing the x-ray images, a software package called Image/Icon is being developed at Yale University. This product both collects images and analyzes their features. After a radiologist scans in an x-ray, he/she can then make use of Image/Icon. This program helps the computer to select database images that show abnormalities similar to those present in the new x-ray, thus enabling the radiologist to make a differential diagnosis. When this software is officially released, it will be used as a tool to teach differential diagnosis, as well as an instrument in radiology laboratories.

To manipulate scanned x-rays into forms suitable for software like Image/Icon, we tested two image-processing packages: Image and ImageStudio. Originally developed for the Public Health Department in the United States, Image is public domain software that we found on a computer bulletin board in the United States. This package has some interesting features, such as a precise image contrast monitor, as well as accurate methods to measure different areas of a scan. Areas irregular in shape can also be measured.

We experienced difficulties in using this software because the scan from the Sharpe scanner was too large to be imported properly, yet the scan was only 8" x 10", which is small for an x-ray. Image managed to open the scan, but issued a warning informing us that due to the large size of the image some of the tools would be unavailable. This made it difficult to conduct a thorough evaluation of the program. We attempted to work with the tools available to us and were not pleased with the results we were getting, so we decided to move on and test another program. Since the 4-megabyte (MB) scan we were using was representative of a scan that would be used by a radiologist, we felt that further testing of this product would be fruitless as the results would not be useful in a hospital environment.

ImageStudio proved to be much easier to use. Initially, we encountered problems importing large (4 MB) scans. To circumvent this difficulty, we changed the setting of ImageStudio's “Set Image Size” option to accommodate the limited memory of our machine. Later, we used various tools to enhance selected shades of grey in an area, diminishing or increasing the contrast. By selecting a certain grey area, or by making one grey more pronounced, it became easier to see a clear image. In the x-rays we have illustrated on pages 13 and 14, you can see how changing the contrast in the image can enhance various aspects of the scan. In *Figure 1*, the harsh contrast allows you to see few areas; in *Figure 2*, the more delicate grey-scale adjustments allow you to see more of the vertebrae in the spinal column, plus a small, curved image underneath the jaw.

To help illustrate the power of these processes, imagine a light grey tumour hidden in a lung x-ray. You can only see a tiny tumour, but you would like to see the area around the tumour so as to make an accurate measure of the tumour's size. With ImageStudio, the image brightness of the section where the tumour is located could be changed, thus allowing you to fine tune the area containing the tumour. By adjusting the settings with the various image manipulation tools, you ultimately will be able to discover more about the true nature of the tumour, such as an accurate approximation of its size as well as how deeply it might be located.

Diagnosing “Off the Screen”

As technological advances continue to make inroads in the field of radiology, hospitals are becoming insistent that all radiologists acquire skills to enable them to diagnose “off the screen” by using the procedures described earlier in this article.

There are several reasons for this. First, radiologists would have access to databases of cases presented in a clear visual format. Improved diagnostics would result from having these large collections of information available.

Further, radiologists in small health-care facilities would be able to send files of x-rays via modem to radiologists in much larger hospitals. The radiologists in the larger hospitals would be able to read the x-rays more quickly and accurately because they will have had greater exposure to a wider variety of problems. This would accelerate diagnosis and the start of treatment, and eliminate the need for and cost of transferring patients from outlying hospitals to urban facilities.

Finally, radiologists could create individual patient files containing a series of x-rays taken during the healing process or the disease progression. Using image processing programs, comparisons could be made between x-rays taken at different stages of the patient's illness.

The Obstacles

Although several electronic tools for making diagnoses now exist, there are some obstacles facing those who might wish to make use of the new technology. Among the most pressing are cost and availability. Although the initial investment in expensive equipment might be difficult to justify, it can be balanced with the money saved by not having to transfer patients between health-care facilities.

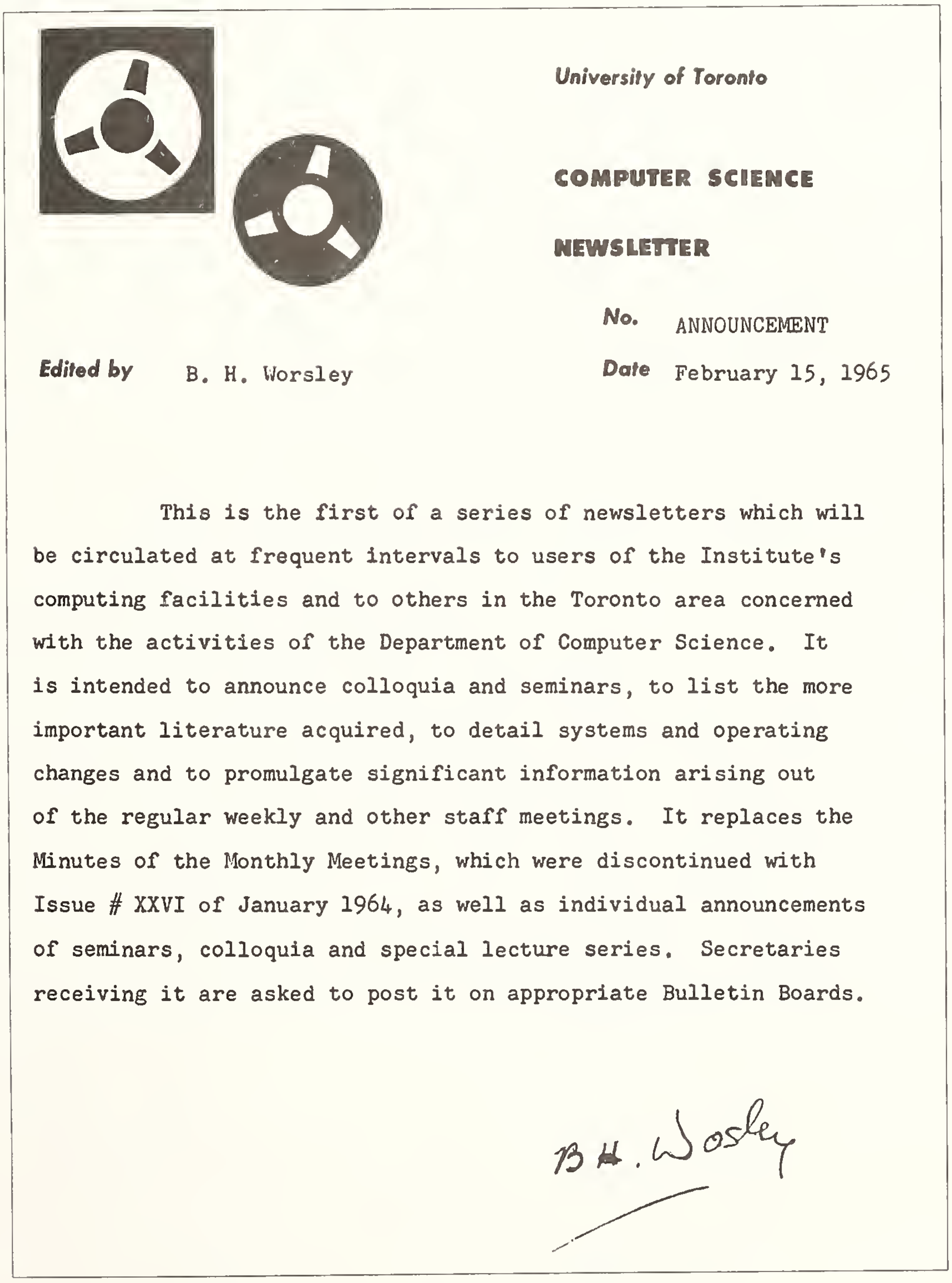
There is also a problem with storage and manipulation of images. We have found that each 8" x 10" image requires 4 to 5 megabytes of disk storage, which is too much if your hard drive has only 20 or 40 megabytes. Large hard drives are falling in price to the point where they are becoming more affordable, plus alternative products, tape drives and optical disks, are now on the market. But they, too, are expensive options. Also, manipulation of images in a product such as ImageStudio requires additional memory in your Macintosh (a minimum of 5 megabytes was needed for our project).

With appropriate hardware and software, radiologists now can have available to them a vast amount of information when making a diagnosis. The challenge lies in how to organize all this information into a usable format to help in patient evaluation. And, while the costs involved might seem to be insurmountable, hospitals can anticipate reduced prices for the necessary equipment in the future. The x-ray of your broken ankle may be on the screen of a hospital Mac sooner than you think.

Twenty-five Years of *ComputerNews*

Maureen Monné
monne@utcs.utoronto.ca

On February 15, 1965, staff members at the Institute of Computer Science (ICS) at the University of Toronto received notice of the creation of a new publication, the *Computer Science Newsletter.* The announcement was made by the late Beatrice Worsley:



University of Toronto

COMPUTER SCIENCE

NEWSLETTER

No. ANNOUNCEMENT

Edited by B. H. Worsley

Date February 15, 1965

This is the first of a series of newsletters which will be circulated at frequent intervals to users of the Institute's computing facilities and to others in the Toronto area concerned with the activities of the Department of Computer Science. It is intended to announce colloquia and seminars, to list the more important literature acquired, to detail systems and operating changes and to promulgate significant information arising out of the regular weekly and other staff meetings. It replaces the Minutes of the Monthly Meetings, which were discontinued with Issue # XXVI of January 1964, as well as individual announcements of seminars, colloquia and special lecture series. Secretaries receiving it are asked to post it on appropriate Bulletin Boards.

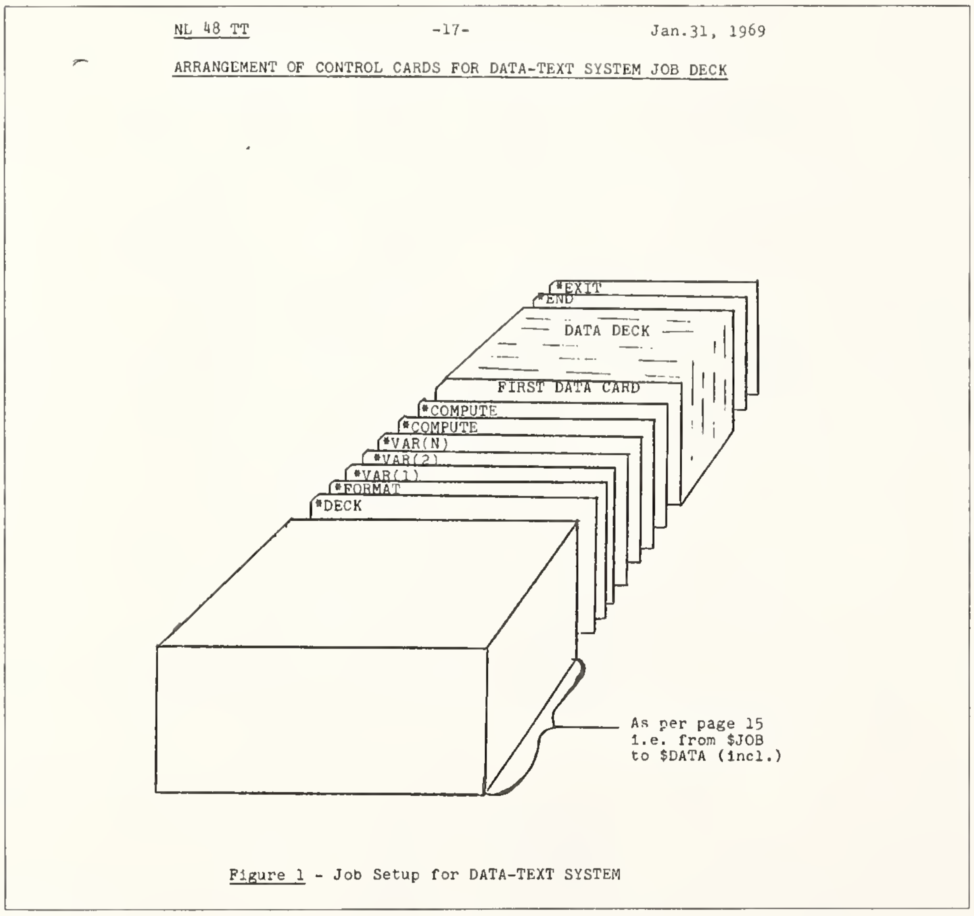
B H. Worsley

The first issue occupied three pages; it listed seminars, a colloquium, lectures, staff changes, the arrival of a software package, a new accounting procedure, and new literature. Twenty-five years later, the newsletter that evolved into *ComputerNews* sometimes occupies as many as fifty pages. Contents include hardware and software reviews, news of general interest to computer users, and a departments section listing University of Toronto Computing Services (UTCS) documents, services, and support.

Visual Darwinism

The early newsletters were circulated several times per month, as warranted by the necessity of announcing events and issues relevant to the department. They were laid out in one column; visual effects included five-character paragraph indents, double spacing, upper-case headlines, and occasional centering of text. Save for the computer-tape logos on the cover, the same as those on the sheet on which Beatrice Worsley's announcement appeared, the first forty-seven issues were devoid of any artwork. Issue 48 was embellished with an illustration of the arrangement of control cards for the data-text system job deck (see *Figure 1*).

Gradual alterations to the appearance of the *Computer Science Newsletter* occurred in the first 105 issues: the covers were printed on blue paper commencing with Issue 79 (August 31, 1971); simple charts became fairly commonplace items; the table of contents was designated as a regular front-page feature; the ICS floor plan often appeared inside the front cover.



NL 48 TT -17- Jan.31, 1969

ARRANGEMENT OF CONTROL CARDS FOR DATA-TEXT SYSTEM JOB DECK

Figure 1 - Job Setup for DATA-TEXT SYSTEM

Figure 1

With Issue 106 (November 1973), however, a significant change occurred. The ICS newsletter received a new name and a new cover logo (*Figure 2*). W.E. Greene provided the explanation in Issue 107:

> *You could not help but notice the new cover on the Newsletter for last month's issue. We apologize for not telling you at that time why it was changed. Due to a last minute crisis (i.e. inability to get "old format" covers) we were forced to make a quick switch to the new format.*
>
> *The purpose behind the change of the name...is twofold. A continuing effort is being made to make this publication distinct and professional looking...*
>
> *The second aspect of the change is to make the publication truly a medium for all computer news of interest to the members of the University. The old name "Computer Science Newsletter" did not fairly represent the fact that the news was from the Computer Science departments, Computer Centre and other interested users such as Zoology and Geology.*

A two-column format was implemented in Issue 108 (January 1974), making for easier reading; until Issue 147 (March 1977), format changes involved relatively simple things such as the addition of a masthead (Issue 120), a tear-out memo calendar (Issues 131-135), and the occasional questionnaire.

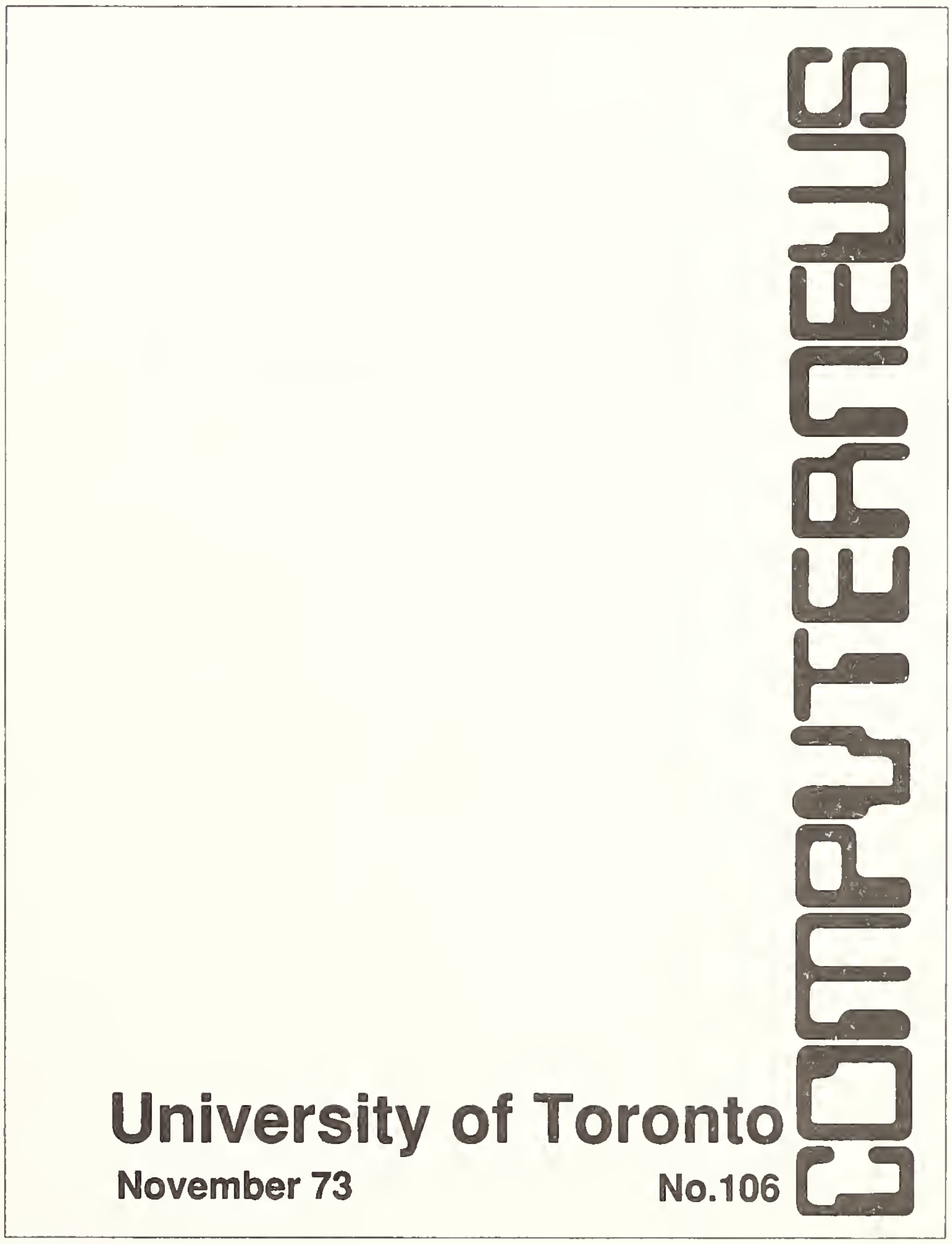
Issue 147 was distinguished by the dramatic cover photo taken during the fire which destroyed most of the Sir Sandford Fleming Building, which was then home to much of the University of Toronto Computer Centre (UTCC). Inside were articles and photos illustrating the severity of the damage, plus UTCC's proposed recovery plan. Following the publication of Issue 147, full-page cover art became a regular occurrence. Readers were treated to photographs of new equipment acquired by the department, people who worked in the department, users of UTCC's facilities, etc. (Those who choose to browse through back issues are reminded time and again of how badly dressed we were during the polyester 70s.)

The distinct, professional appearance sought by W.E. Greene was realized with Issue 173, September 1979. For 28 issues, front and back covers were printed on coated cover stock. The current *ComputerNews* and UTCS logos made their debut, albeit horizontally instead of vertically (*Figure 3*). The familiar, two-column format remained, but a certain elegance was added by the change in typeface and rigourous adherence to a few simple style formats. Camera-ready art was generated on a CAT/8 typesetter, so smudgy-looking text became a thing of the past. Those who worked in the department when these issues were being produced recall that it was the limitations of the software being used at the time which imposed the stylistic restraints.

The 200th issue of *ComputerNews* (July/August 1982), replete with congratulatory cake on the cover, was the last to appear in this format. Because of hiring freezes within U of T and general budget constraints, a simpler, less expensive format was adopted.

Commencing with Issue 201, the cover as we know it today made its appearance. White bond paper replaced the coated cover stock. Although the pages inside retained the same format, the substitution of the Table of Contents for eye-catching artwork had a deflating effect.

Issue 240, July/August 1987, was the first to be produced on the Macintosh. Immediately visible differences included the change in typeface from Times Roman to Helvetica, plus the inclusion of more graphics. Since that time, the publications group has given careful consideration to fine tuning the appearance of *ComputerNews*. The flexibility and ease of use afforded by Macintosh systems and software, particularly in respect to graphics, have enabled the group to circulate a magazine which, we hope, is visually appealing as well as technically informative.



COMPUTERNEWS

University of Toronto

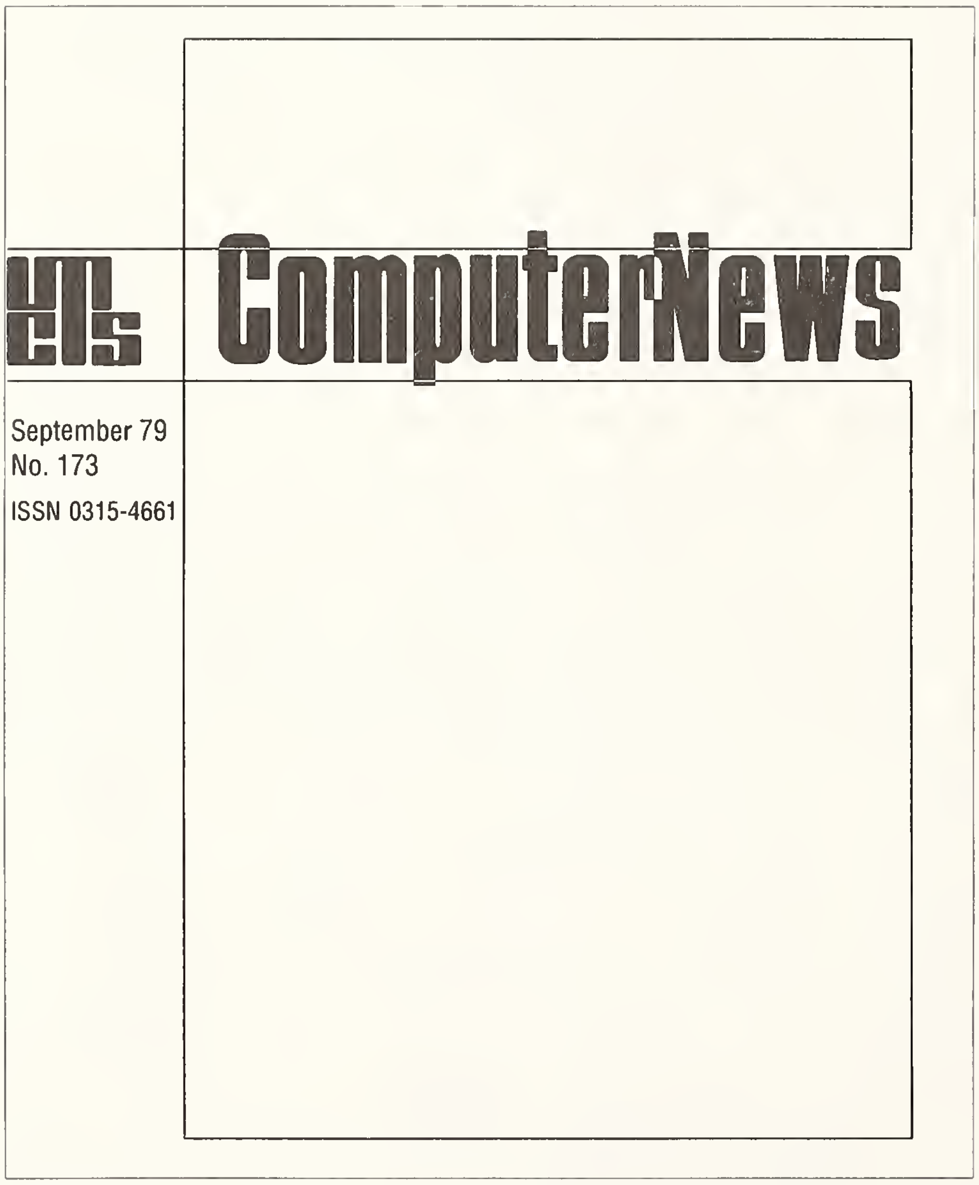
November 73

No.106

Figure 2

It's What's Inside that Counts

Your mother was right when she said, "Don't judge a book by its cover." Over the years, the pages of *ComputerNews* have been packed with up-to-the-minute reports about developments in computing, departmental information, and features of general interest. Following are snippets culled from the archives.



ComputerNews

September 79
No. 173
ISSN 0315-4661

Figure 3

Number 2, March 1, 1965

New Hardware

On April 1st next the following equipment will be added to existing ICS facilities:

CALCOMP Plotter - 11" wide continuous single ink-pen paper plotter (Model 565), driven by CalComp magnetic tape drive (Model 570).

IBM 1460, primarily for use as an off-line I/O device for the 7094-II. It will feature:

Card reader 800 cards/min

Line printer 1100 lines/min.

One magnetic tape unit (Model 729 IV)

Newsletter 4, April 1, 1965

Addenda

To Newsletter 2 page 2, description of the IBM 1460, add "8K core store".

Newsletter 17, April 22, 1966

Colloquium Announcement
Student Chapter ACM
Friday, April 19, Room 101,
McLennan Lab

Professor John McCarthy, Department of Computer Science, Stanford University, will give two lectures:

2:00 pm "Proving Compilers Correct"
3:30 pm "Philosophy Made Easy for Robots"

Number37,November1,1967

Computer Room Etiquette

The rule in Computer Room 111 is NO SMOKING. The greatly increased inventory of equipment includes several units which are fussy about cleanliness, particularly the 2314 Disk system. The fire alarm system will also respond to the ionized particles of any smoke.

All personnel with right of access to this room will be obliged to observe this rule.

Number 41, April 30, 1968

From "OS RELEASE 12"

(1) Main storage size is 524,288 bytes (512K).

(8) Design level of the sequential scheduler is 100K.

(9) System utilities, sort/merge functions, and the ALGOL, COBOL, FORTRAN E, and PL1 compilers will execute using 128K bytes of main storage.

Number 42, June 12, 1968

$JOB NAME STANDARD

Users are requested to meet a standard format for the name field in $JOB cards. Specifically, arrange the Name entry so that recovery of output from Room 113 is by first letter in the field, e.g. $JOB Jake Gizzard will be held under Jake, not Gizzard.

Coming Events

The S/360/65 now sits on the floor in Room 111 Old Physics....for user planning, its configuration is

- 512 K memory
- 2314 Disk Unit
- 2, 7-track tapes
- 2, 9-track tapes
- I/O via Dispatcher.

Number 47, December 30, 1968

1968 - THE WILD YEAR

Student Power! Transplants! Memphis, Los Angeles and Chicago! Trudeau! DISPATCHER!!! Who will ever forget 1968?....

OCTOBER: "Stuttering" was identified as a hardware fault and cured, thanks to its tendency to grow from an occasional bother to complete disaster without any change in software. The phenomenon, repetition of block of data on remote input, sufficiently bemused Bruce West that it was reported in his November 19 column in the *Globe and Mail*.

Number 48, January 31, 1969

ICS PERSONNEL

Users may have discovered that two smiling young ladies have been added to the Output Service section. Miss Diane Goltz and Miss Nancy Okada add a woman's touch to that vital service, and are but the vanguard of an overall increase in operations staff.

[Did we really say that?]

Number 68, September 30, 1970

CHANGE OF NAME

The Institute of Computer Science is on its way to the archives of memory. The Policy Committee of "ICS", supported by recommendations of the staff, has applied for official sanction to rename our organization. It would be called the University of Toronto Computer Centre, Computer Centre for short and UTCC for those who like initials.

The new name emphasizes the service role which ICS has been playing since the formation of the graduate Department of Computer Science several years ago. The name helps obviate a persistent confusion between the identities of the Centre and the Department.

The phrase Computer Centre will be use increasingly. Revised letter heads will be adopted upon official sanction for the change.

[The name change was made official on October 22, 1970, and was noted in Number 70, November 30, 1970.]

Number 89, June 30, 1972

GRAFFITI POWER *C.A. Ford*

Opposite the word YESTERDAY on a UTCC bulletin board an unknown graffiti artist added a few words paraphrasing those of a familiar song. The idea suggested a full chorus printed below. May the Beatles and IBM forgive our levity.

Yesterday All My Program Bugs
Seemed Far Away
Now It Looks As If They're Here To
Stay
Oh I believe in Yesterday

Suddenly I'm Not Half The Whiz I
Used To Be
There's An Abend Hanging Over Me
Oh Overtime Comes Endlessly

O S Doesn't Help Me Keep My
Sanity
J C L Will Drive Me Into Lunacy

Yesterday Coding Was An Easy
Exercise
PL/One Leave Places Bugs Can
Hide
Oh Who Needs OS On His Side?

Number 100, May 31, 1973

S/370 MEMORY...IT'S NOT CORE ANYMORE! *R. Cavanagh*

Since April 29 the use of the term "Core" has been obsolete on S/370. At approximately 10:30 p.m. on that date the installation of two megabytes of MOS (Metal-Oxide-Silicon) memory was completed...

Number 104, September 28, 1973

ONE BILLION BYTES *J. Lees*

During the last week of September, S/370 Services installed an IBM 3830 controller and two IBM 3330 disk drives. The acquisition of these drives now makes available over one billion bytes of on-line storage (1,175,056,000)....

Number 11, April 1974

Metrification and Computing
Derry Cox

(4) Mathematical Algorithms

As a parting whimsy, consider the following (less than critical) data processing problem in British units and how much simpler things would be with metric units.

If 1 gallon of scotch weighs 10 lbs. and 1 cubic foot of soda weighs 62.5 lbs., how many bushels of computer card chips are there in a cubic yard? (Hint: Gallons are Imperial measure, the specific gravities of scotch and soda are both approximately 1 if the scotch is cheap enough and the soda is flat).

[The results of this challenge were never published, so you're on your own if you decide to give this teaser a try!]

Number 112, May 1974

HSJS NEWS AND MONTHLY STATISTICS

...During this past year, the number of jobs increased 28.7% from 1,132,527 to 1,457,135. The number of cards read increased 18.0% from 150,637,000 to 177,797,000, while the number of lines printed rose 41.3% from 150,637,000 to 212,850,000.

To put these figures into perspective, we have made a few comparisons. If 50 lines were printed per page and the output placed in a pile it would create a stack of paper 1612 feet high or 193 feet shorter than the CN Tower and would weigh over 72,562 pounds. There would be enough paper to cover every floor of the Commerce Court Building twice over, or to stretch 923 miles. If the cards were placed in card boxes and laid end to end, the line would be over 16 miles long; long enough to WARDEN station along the subway line, with enough to cover the St. George to Yonge and Bloor section of the Yonge University line as well. The total card weight would be 677,866 pounds or equivalent to the weight of 338 Volkswagons. There would be enough cards to create a swath 215 feet wide along the entire TTC subway lines.

Number 136, May 1976

UTCC: 1975/1976 *Rein Mikkor*

...UTCC is now in the process of increasing the main storage on the S/370-165-II from three megabytes to four megabytes...the S/370-165-II is limited to a maximum of three megabytes of main storage. It is expected that the fourth megabyte will be operational sometime in June, 1976...

Number 138, July 1976

MYTHS ABOUT ERASURES DISPROVEN
adapted from "Erasing Myths About Magnetic Media", by Sidney B. Geller, Datamation, March 1976.

The Myth

Airport metal detectors can erase tapes.

The Truth

Tests performed at Washington National and Dulles International airports showed no instance of erasure or data loss after tapes were moved through metal detectors in many different locations within the detector....Handheld metal detectors caused no data loss, nor did X-ray inspection...

The Myth

A large electromagnet, such as the type used for lifting scrap metal in a junk yard, could be concealed in a van outside a computer centre and a properly aimed burst of magnetism could erase all the tapes within.

The Truth

This theory was tested in a scrap yard by placing a large lifting magnet directly over tapes....it is the distance from the magnet that is most important. At 1.3 feet, the closest distance tested, there was no loss of data.

The Myth

X-rays erase tapes.

The Truth

X-ray intensities sufficient to kill a man caused no loss of data.

The Myth

Radiation around a microwave oven can erase tapes.

The Truth

Cassettes were warmed inside a microwave oven with no loss of data.

Number 153, November 1978

Personal Computers *Sally Holton*

...Although the future impact of small computers is not clear, some trends are discernible. The equipment will become less expensive – some people predict that equipment costing $4000 now will sell for $100 by 1985....

Number 167, February 1979

Directors [sic] Note

Dr. Doron J. Cohen

...As computing becomes increasingly available to the general public and as attitudes towards computing change, we who provide computing must change our attitudes as well... While UTCC has always recognized the need to take computing to the user, we must continue to improve the channels through which we deliver usable computer based products. It is for this reason that an increased emphasis will be placed on the service aspect of computing at the University of Toronto. Symbolic of this awareness is a change in name for UTCC. UTCC recently received permission to change its name to University of Toronto COMPUTING SERVICES (UTCS). While a name change in and of itself means little, we hope that the change will indicate our awareness of the changing role of computing not only at the University, but in society as well.

Number 217, September 1984

Where Do Toronto's Wealthy Live? *Diane Mitchell*

For flexibility and speed, the census tapes are an extremely valuable resource.... questions are...asked about incomes, housing, the work force and cultural characteristics. You can find out how many bathrooms the average Canadian dwelling has.... I was able to get a simple answer [to where the wealthiest Torontonians live] in only thirty minutes – using the University's collection of 1981 Census Tapes.

Area	Income
The Bridle Path area	$49,016
Harbour Castle	$48,435
Forest Hill	$36,391
Yonge, Eglinton, Bayview & St. Clair	$30,272
Rosedale	$30,197
Yonge, York Mills R., Bayview & Lawrence	$29,508
The Annex	$28,567
Humber Valley Village	$27,906
Rosedale (a different section)	$26,395
Kipling, Eglinton, Islington & Rathburn	$26,266

Number 220, January/February 1985

Card Punch Service to be Discontinued *Bob Chambers*

On May 1, 1985, UTCS will discontinue the card punching service at the UTCS Central Site. This service has been used less and less over the past year, and usage is now so low that the cost of providing the service is several times higher than the revenues it generates....

Paper Tape Service Discontinued *Bob Chambers*

UTCS discontinued its paper tape reading/punching service as of February 1, 1985. The paper tape reader and punch had been idle for at least six months, and there had been no transactions affecting the paper tape library for an even longer period....

25th Anniversary Fun & Games

The Literary Exercise

Write a sentence using the author's favourite program names: MOIST, DAMP, SPITBOL, TIDY.

The Quiz

The following is reprinted from Issue 200, July/August 1982

Computers in the Movies

(Reprinted from the North Dakota State University Computer Centre Newsletter, vol. XVII, No. 5, 1982.)

The following is a trip down trivia lane to determine if you have kept up with Hollywood's portrayals of the machines so dear to our hearts. Movies in which a computer plays an integral part tend to depict them either as monsters turning on their masters or as mysterious boxes only understood by an eccentric group of college geniuses. Obviously, we need to work on PR.

In case you are stumped, the answers will be printed at the back of this issue of *ComputerNews*. Good luck with the quiz and have a good summer.

1. Name the futuristic movie directed by George Lucas and starring Robert Duvall which portrays a dehumanized society where love is outlawed and computerized confessionals keep citizens in line.
2. Probably the most famous computer in film is the soft-voiced member of the crew of the Discovery in the film *2001: A SPACE ODYSSEY*. Can you name this computer which turned on the crew members?
3. What, if anything, does this name signify?
4. As Dave releases the memory units in the above film what song does the computer begin to sing?
5. PROTEUS is a computer that can think; unfortunately for Julie Christie, it also lusts after her and finally has its way with her. Name this strange 1977 film.
6. Can you name the 1970 film where an American super-computer, named Colussus, and its Russian counterpart, Guardian, team up to take over the world and save it from mankind?
7. Even Spencer Tracy and Katherine Hepburn got into the act in a film called *The Desk Set*. Tracy played a computer expert for what computer company in this film?
8. In the film *Alien*, what is the name of the computer that the crew members consult to obtain instructions as to what to do with the intruder?
9. Name the Disney movie where the typical college computing whiz gets zapped by a computer and, naturally, absorbs all of the computer memory into his body.

Quiz Answers

1. THX 1138
2. HAL 9000
3. While the acronym is popularly thought to be a one letter transposition of IBM (each letter decreased by one), Arthur C. Clarke, the author of 2001 and the co-producer of the movie, claims that this is not so. He states that HAL stands for Heuristically programmed ALgorithmic computer.
4. "Daisy" (also known as "A Bicycle Built for Two")
5. Demon Seed
6. Collusus: The Forbin Project
7. IBM
8. Mother
9. The Computer Wore Tennis Shoes

Serious Matters

Now that we have indulged in a bit of hilarity, it's time to get back to business and recognize some of the milestones of the little newsletter that grew.

Number of Cover Designs:	4
Number of Editors:	17
Most issues edited by:	C.A. Ford, Issues 34 -49 and 54-101
Best Cover:	February/March 1977, after the Sandford Fleming fire
Best Article Name:	Tie between "Cool, Man!! But What's a HASP?" and "Waste Basket Wins $2000 Scholarship"
Sadly-Missed Social Event:	4:00 tea before each colloquium

And So...

Thus concludes our retrospective of *ComputerNews.* Those of you who are interested in looking at the back issues from which this information has been gathered are welcome to visit the library in our Microcomputer Lab at 4 Bancroft Avenue. Hours are from 8:45 a.m. to 5:00 p.m.

Magnetic Tapes Available – Free

Robert H. Chambers
bobc@vm.utcs.utoronto.ca

As a result of a conversion to newer technology, UTCS has a surplus of used, 1/2 inch, 2400 feet magnetic tapes. These tapes are available to university members free of charge. UTCS provides no guarantee of the quality of the media as these used tapes are of varying ages.

For further information, please contact Dave Wong in person in Room 368 of McLennan Physical Laboratories, by phone at 978-6303, or by e-mail at davidj@vm.utcs.

WordPerfect Purchases and Upgrades: Taking Advantage of Educational Pricing through UTCS

Harriet Hua Ji
huaji@gpu.utcs

University faculty and staff who use, or plan to use, WordPerfect (WP) on campus can upgrade or purchase their software at a reduced price if they join the UTCS "site license" agreement. For $10.00, you can upgrade any old, licensed version of WP to the current Version 5.1. For $65.00, you can purchase a new WP license. These licenses are restricted to employees of U of T and **cannot be used off campus.** Manuals cost extra. See "Documentation Costs" below.

The site license is particularly attractive to departments with multiple copies of WordPerfect. If you have ten individual licenses, you could upgrade all ten to version 5.1 for $163, including one complete set of manuals. One regular update, with manuals, costs about $114 ($95 in US funds). Even if you were to purchase manuals with all the ten upgrades ($730 total), you would still realize a savings of about $400 over the regular upgrade price.

For departments contemplating new purchases of WordPerfect, the UTCS site license purchase provides initial savings as well as long-term benefits. A new site license with documentation is $155 (as opposed to $200-$300 elsewhere) and future upgrades will be available at the preferred rate. The value of the savings outweighs the educational restrictions (see below) placed on these licenses.

Upgrading

The site license will be administered in the same manner as our SAS and SPSS/PC licenses. The software is available on disks which you copy to your hard disk. You may also make one copy for backup purposes. You must reserve the diskettes, in advance, by phoning the UTCS Information Office at 978-4990 and a $25.00 deposit is required. (The deposit is refunded when you return the disks.)

To upgrade to version 5.1 of WordPerfect, bring the following to the UTCS Information Office, 4 Bancroft Avenue, Room 201:

1. The original title page from your WordPerfect Reference manual.
2. Your WordPerfect serial number.
3. The type of keyboard you are using: standard or extended.
4. The printers you are or will be using with WordPerfect.
4. A list of the manuals you wish to purchase.
5. Your U of T Employee number.
6. Payment, including disk deposit, in the form of cash, cheque, UTCS CAN, or U of T Appropriation Account.

The upgrade fee includes a new keyboard template and quick reference card.

Purchasing

To purchase a new WordPerfect 5.1 license, bring your payment, plus the following, to the UTCS Information Office:

1. Your U of T Employee number.
2. The type of keyboard you are using: standard or extended.
3. The printers you will be using with WordPerfect.
4. A list of the manuals you wish to purchase.

You will also have to reserve the disks in advance by phoning 978-4990.

Documentation Costs

For upgraded licenses, manual costs are:

Reference manual, binder and slipcase	$40.00
Workbook only	$23.00

For new licenses, manual costs (including binder and slipcase) are:

Complete documentation	$90.00
Reference manual only	$66.00
Workbook only	$25.00

You may purchase only one set of documentation per license or upgrade.

Educational Restrictions

If you upgrade or purchase WordPerfect under the UTCS site license agreement, you become a member of our site. The low cost is possible because technical support for WordPerfect problems is handled by UTCS and the licenses are limited to use on campus. The licenses must be paid for with University funds. In addition, you cannot transfer your license to another person and, if you leave U of T, the license remains the property of the University.

For More Information

If you require more information about WordPerfect 5.1 or WordPerfect site licensing agreements in general, contact Harriet Hua Ji at 978-6050. For information about UTCS site license purchases or upgrades, contact the UTCS Information Office at 978-4990.

WordPerfect 5.1 is Here!

What's in it for You?

Attend a free UTCS demonstration and see.

Tues., February 13, 1990	10 a.m. - 12 noon
Wed., March 7, 1990	10 a.m. - 12 noon
Thurs., March 29, 1990	10 a.m. - 12 noon
Wed., April 11, 1990	2 p.m. - 4 p.m.

To register for one of these demonstrations, contact Irene Rosiecki at 978-4565. Space is limited.

COREL DRAW

Terry Jones
tj@vm.utcs.utoronto.ca

COREL DRAW, release 1.1, has been available for a few months now. For those unfamiliar with the package, COREL DRAW is a freehand drawing program for MS-DOS computers. It gives PC users a powerful tool for creating illustrations that can be included in papers and documents or printed as posters and signs for advertising.

Looking at *Figure 1*, we can see a few of the many capabilities of COREL DRAW. Two views of the drawing in progress are visible. The view on the left is the drawing area. The one on the right is a preview of the final output. (The preview option can be turned on, for convenience, or off, for maximum performance.) What should be immediately obvious is the quality of the text on the screen. COREL uses scaleable outline fonts which display highly accurate screen views of text. Scaleable outline fonts show what the actual result will look like whereas the alternative, bitmaps, tend to distort individual characters upon magnification. Manual kerning, fitting letters closer together or further apart, is very easy because of the exact screen display. Another advantage of using outline fonts is that you can "grab" these fonts and be creative with them, treating the text as graphics. For example, in *Figure 1,* the single letter P has been modified to open up the bottom curve. This effect is often used in headlines and logos. Sentences, words, or individual letters may also be stretched and rotated as desired. Again, the COREL outline fonts make it very easy to see exactly what the result will look like as you're working.

People with demanding typographic needs will especially appreciate the way COREL DRAW handles fonts. Not only is manual kerning made easier but, also, you are not limited to using the fonts that are provided with COREL DRAW. COREL provides a utility program that allows you to use Adobe or Bitstream fonts, while still getting the same high-quality screen display.

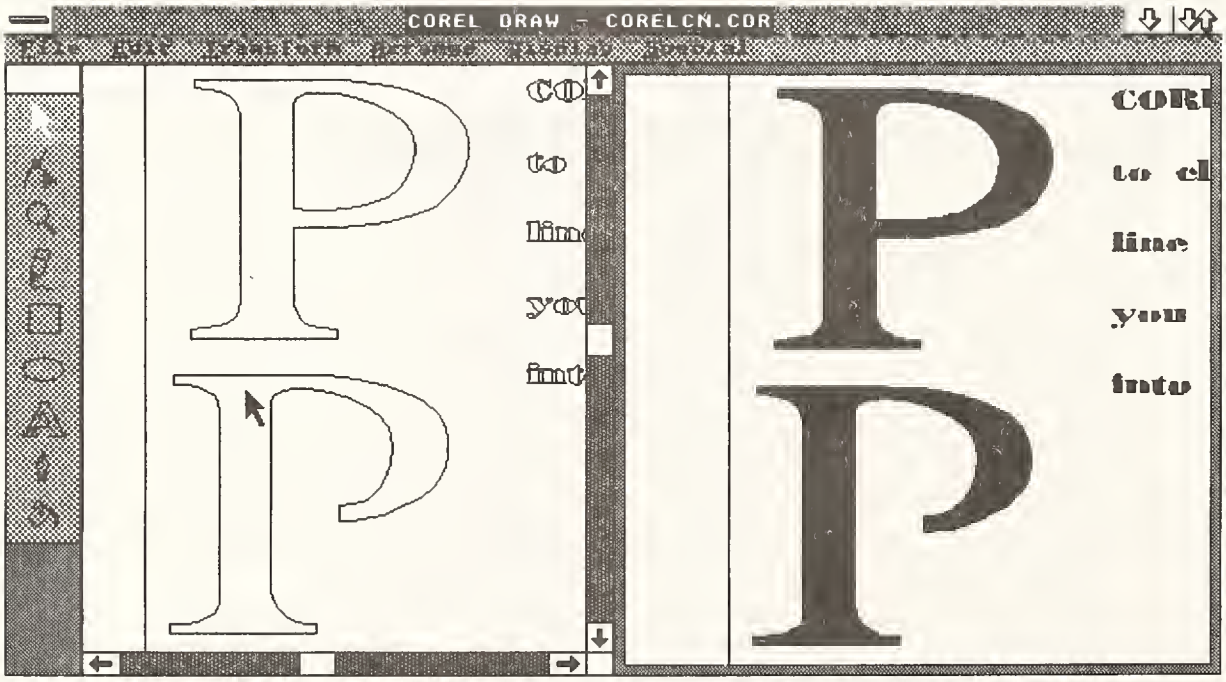
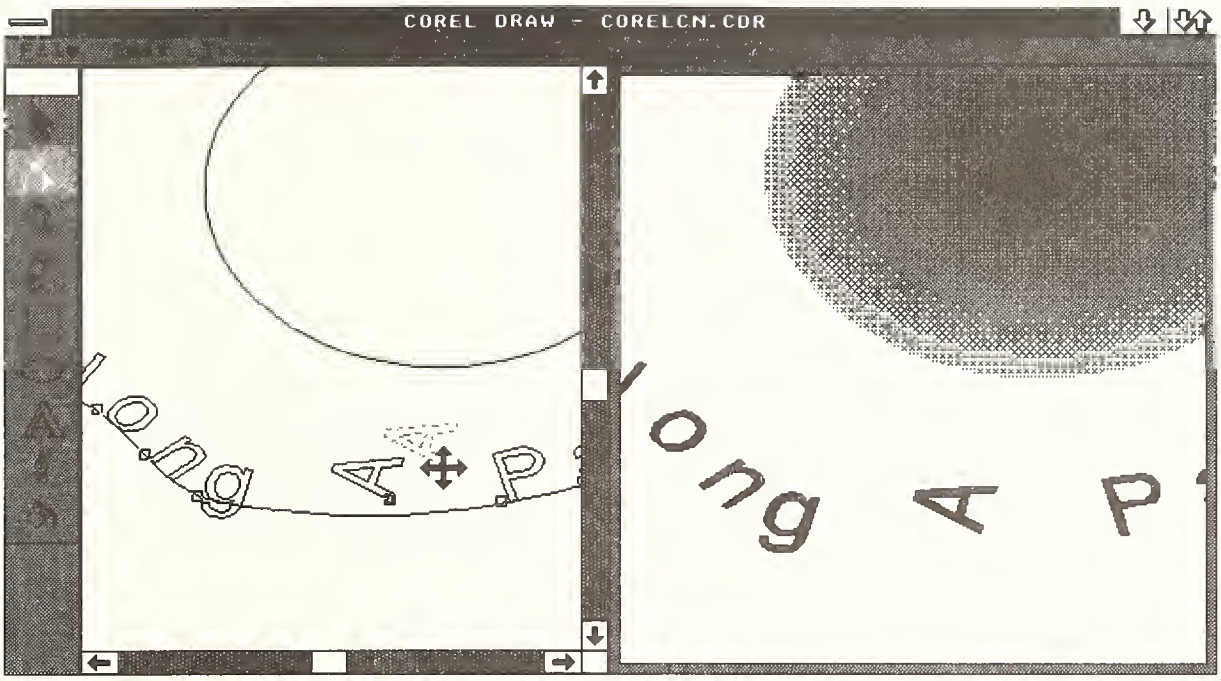


Figure 1



Two views illustrating how COREL DRAW allows you to bind characters along a path

COREL also has drawing tools for creating circles, ellipses, rectangles, squares, and other shapes. You have full control of the style parameters, such as colour and line width, for both the outline of the objects you create and the fill patterns of these objects.

The import and export capabilities of COREL DRAW are excellent. This package allows you to work with graphics in a large variety of formats, including Lotus PIC files, PC Paintbrush PCX files, and scanner TIFF files. Conversely, COREL can export to a number of different formats, including TIFF and Encapsulated PostScript forms most useful for desktop publishing purposes. In general, COREL graphics can be used with PageMaker, Ventura, WordPerfect 5.0 and 5.1, Microsoft Word 5.0, and other word-processing and desktop-publishing programs.

Bitmaps (scanned TIFF images and "paint" images) may be brought into COREL and printed, or they may be traced and turned into COREL DRAW objects. The COREL autotrace facility takes a lot of the work out of converting scanned images into high-quality artwork.

One of the most appealing features of COREL DRAW is that it supports Hewlett-Packard LaserJet printers almost as well as it supports PostScript laser printers. Not only is stunning colour available with the Hewlett-Packard PaintJet printer, but you can take advantage of COREL DRAW's scaleable outline fonts to successfully print large text.

Compared with similar illustration programs on the Macintosh, COREL DRAW is easier to use and understand.

For those interested in purchasing the package, note that COREL DRAW requires at least an AT-class microcomputer running Microsoft Windows. The package comes with hundreds of sample clip art, as well as a videotape that teaches you how to use the program. The documentation is clear, concise, well-illustrated, and supported by useful references. COREL DRAW compares favourably in both cost and functionality with its competitors on both the PC and Macintosh.

For more information about COREL DRAW, call Terry Jones at 978-4924.

SAS Data: Moving from Mainframe to Micro (and back)

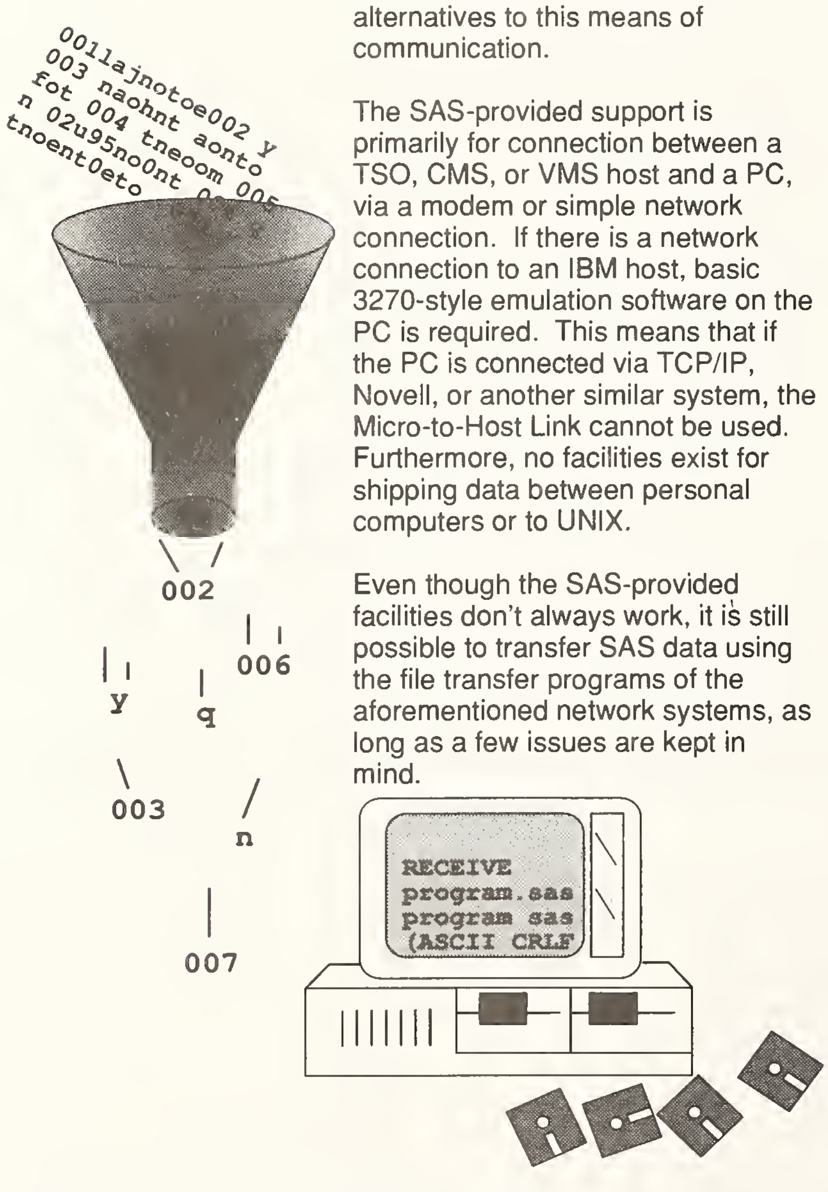
Barry Lay
barry@vm.utcs.utoronto.ca

In the modern world of distributed computing, it is not uncommon for someone to wish to transfer data between different computer systems. The data may start on a mainframe system and end up on a microcomputer, be transferred to a UNIX system, or be moved between PCs.

The SAS Micro-to-Host Link facilitates the transfer of data between different systems, but is not designed to handle many of the popular connection methods. Hence, this article will examine alternatives to this means of communication.

The SAS-provided support is primarily for connection between a TSO, CMS, or VMS host and a PC, via a modem or simple network connection. If there is a network connection to an IBM host, basic 3270-style emulation software on the PC is required. This means that if the PC is connected via TCP/IP, Novell, or another similar system, the Micro-to-Host Link cannot be used. Furthermore, no facilities exist for shipping data between personal computers or to UNIX.

Even though the SAS-provided facilities don't always work, it is still possible to transfer SAS data using the file transfer programs of the aforementioned network systems, as long as a few issues are kept in mind.



File Transfer

One standard function of virtually all local networking products is file transfer, a method for sending a file from a mainframe system to a PC. This type of program generally comes with both PC and mainframe components, and allows transfer in both directions. There are usually several options for such programs, as file formats between the PC and the mainframe often differ.

IBM mainframe users encounter a fundamental difference in file formats, in that large IBM processors represent character data in Extended Binary Coded Decimal Interchange Code (EBCDIC), whereas most other computer sytems, including DOS, VMS, and UNIX, operate in American Standard Code for Information Interchange (ASCII). This means that a file with text readable on the mainframe must be converted when it is transferred if it is to be readable on the PC. Most file transfer programs will do this in both directions. Kermit, a typical file transfer program, does this by default, but an option exists to disable this automatic conversion.

A feature unique to IBM mainframes is the existence of fixed-length records in character files. SAS programs, for example, are usually kept in files with eighty byte records, primarily for historic reasons. As the PC did not originate with the keypunch technology stream, it has little use for this antiquated filing system. PC files, then, need to use an alternate method for terminating lines, but most file transfer programs can deal with this. For example, to send a SAS source program to a PC running the Emulation Program on an IBM Token Ring, use:

```
RECEIVE program.sas program sas (ASCII CRLF
```

where "program.sas" is the DOS file name, and "program sas" is the mainframe data set name. The ASCII option tells the file transfer program to convert EBCDIC to ASCII, and the CRLF option tells it to put carriage return/ line feed at the end of every line.

Readable raw data files can be shipped in the same way, provided that they contain only text.

SAS Files

The main complication with data transfer and SAS involves dealing with SAS data sets. When data is stored in SAS internal format, it has been optimized for use by SAS procedures. There is a header section containing important information about the data set, and the data itself is stored in machine-usable form. On an MVS system, there may be more than one SAS data set in an operating system file.

This last point indicates that SAS does not treat libraries on different systems in the same manner. A SAS library is a collection of SAS data sets referred to by a library reference. The reference is the first part of the two-part data set name used in procedures and data steps. That is, if the data set is created with

```
     DATA PROJECT.SET1;
       ... other instructions ...
```

the library reference is PROJECT. On MVS, all data sets in the library are stored in one operating system file. The DDName of the file, when allocated, is the library name (PROJECT, in this case). This reference can be made by the DD statement in JCL, the ALLOCate statement in TSO, or the LIBNAME statement in SAS. On CMS, data sets are stored in individual files with a filetype corresponding to the library name. In the above example, the data set will be saved in a CMS file called 'SET1 PROJECT A'. On the PC and in UNIX, data sets are stored in individual files in separate subdirectories for each library, with the relationship between the directory and the library name established via the LIBNAME statement. If a library reference was created with

```
     LIBNAME PROJECT 'C:\PROJ';
```

the data set would be saved in a 'C:\PROJ\SET1.SSD'.

Additionally, different machines use a variety of methods to store floating point numbers, which is how numeric data is represented in SAS. With imbedded character strings in EBCDIC, floating point numbers here and there, and diverse library structures, it is not possible for a generic file transfer program such as FTP to convert SAS data sets successfully.

SAS Transport Files

In order to get around the problems imposed by the various library formats, amongst other things, SAS has a special format called a transport file. This file is designed to be standard across the different computing systems (or "platforms"), and provides the basis for data transfer.

The procedure XCOPY converts SAS libraries on the IBM mainframe to this special transportable form. This procedure is similar to PROC COPY, but has two extra keywords, IMPORT and EXPORT, to specify the conversion direction. PROC XCOPY supports SELECT and EXCLUDE for data set names, in a fashion similar to PROC COPY.

Since the transport data set has to be standard on different platforms, character data needs to be represented in one way for all. The choice made was ASCII, which implies that when transport data sets are being transferred from system to system, they should not go through EBCDIC to ASCII conversion. The conversion procedures at either end take care of the local library and data formats.

SAS Version Differences

In addition to remembering the different methods for storing libraries and data, one also has to take into account that, for the moment at least, the versions of SAS on the mainframe and the micro exist at different levels.

Between Version 5 and Version 6, the logical structures of the SAS library and catalogue have changed so that now there are many more types of data sets in a catalogue under Version 6 than there are under Version 5. Accordingly, the transport file format has changed too. So, while transport files are the same across platforms, they are not compatible between versions.

The actual method for creating transport files has been altered. Two procedures, CPORT and CIMPORT, are used in Version 6 for transferring data sets, libraries, and catalogues. They also exist in Version 5, but for transferring only SAS/AF and FSP catalogues. These procedures are documented in the SAS/AF manual for the mainframe, even though they are supported in the base product.

To ensure an intact conversion, the procedure for importing Version 5 transport files into Version 6 uses a completely new construction for SAS: the input/output engine. This is a specification on the LIBNAME statement, which tells SAS to use a special program to convert the input file while it is being read or written. In this case, the SASV5XPT input/output engine will make a Version 5 transport file look like a Version 6 library, as far as SAS procedures and data steps are concerned.

Now that we understand that procedures will vary according to system and software, we can illustrate the entire host-to-micro transfer process. First, create a transport file on the mainframe. Assume that the SAS data sets to be copied to the PC are in an operating system data set called ‘APPLIC.PCSTUFF.SASDB’ on MVS. Some sample job control language (JCL) to export follows:

```
//PCSTUFF JOB  PC-COPY,’COPY TO PC’
//EXPORT EXEC  SAS
//PCSTUFF  DD  DSN=APPLIC.PCSTUFF.SASDB,
//             DISP=SHR
//EXPORT   DD  DSN=APPLIC.PCSTUFF.EXPORT,
//             DISP=(,CATLG),
//             SPACE=(CYL,(1,1)),
//             DCB=(RECFM=FB,LRECL=80,
//             BLKSIZE=8000),
//             UNIT=SYSDA
//SYSIN    DD  *
  PROC DATASETS DD=PCSTUFF;
    /* FOR DOCUMENTATION */
  PROC XCOPY IN=PCSTUFF OUT=EXPORT EXPORT;
/*
//
```

The operating system data set ‘APPLIC.PCSTUFF.EXPORT’ contains the SAS library in transport format.

Next, request the download of the file on the PC (in the DOS session). For a 3270 PC running the Workstation Program, assuming the mainframe session is in window A, use the following command:

```
C:\> receive c:\pcstuff.exp
a:applic.pcstuff.export
```

Note the absence of the ASCII and CRLF options. Once the file has been received, run the following PC SAS program:

```
LIBNAME EXPORT SASV5XPT ‘C:\PCSTUFF.EXP’;
PROC COPY IN=EXPORT OUT=WORK;
PROC DATASETS LIBRARY=WORK;
     /* FOR COMPARISON */
RUN;
```

You will, no doubt, want to save the data sets in a permanent library.

Once the basic concepts are understood, the extension of this technique to other connection methods is fairly logical. Let’s look at the equivalent procedure using TCP/IP hooked up to VM via Ethernet, as an example.

Assume that the SAS data sets are in the CMS files ‘xxx PCSTUFF A’, where ‘xxx’ represents a variety of names. To create the export file, run the following in CMS SAS:

```
CMS FILEDEF EXPORT DISK PCSTUFF EXPORT A
     (LRECL 80 BLKSIZE 8000 RECFM FB;
PROC DATASETS DD=PCSTUFF;
    /* FOR LATER COMPARISON */
PROC XCOPY IN=PCSTUFF OUT=EXPORT EXPORT;
RUN;
```

The transport file is now in ‘PCSTUFF EXPORT A’. On the PC, invoke the file transfer program. (Note that some versions of PC TCP/IP have slightly different commands.) Comments to the right are not part of the commands.

```
C:\> ftp vm.utcs             * ‘vm.utcs’ is
                               the Internet
                               address
FTP> user vmuserid           * your vm userid
FTP> password pswd           * your vm pass-
                               word
FTP> bin                     * set binary
                               transfer mode
FTP> get pcstuff.export
FTP> quit
```

The previous PC SAS program will work here to convert the transport file to a library. Almost any host-to-micro file transfer facility will work, as long as it has a binary transfer mode. Some network mail implementations have special output classes to accomplish this purpose for minicomputers, while others have an option on the minicomputer "receive" command.

SAS Graphics

The output of SAS/Graph may be sent across a network subject to certain limitations. Raster-oriented graphics output for printers, such as the HP LaserJet, are binary files, and should be treated as such. On the other hand, there are "readable" device-dependent graphics files. Output for PostScript printers and Computer Graphics Metafile files are text-based and should be converted from EBCDIC to ASCII. This is an area which typically involves experimentation; therefore, consultation with the UTCS Text/Imaging Support Group (978-4924) is encouraged.

For further information on transferring SAS data, contact Barry Lay at 978-6509.

New SAS Courses

Irene Rosiecki
rosiecki@vm.utcs.utoronto.ca

Intermediate SAS - Statistics

This hands-on course focusses on the statistical procedures included in SAS/PC. While some background in applied statistics would be helpful, it is not essential, as the emphasis of the course is the SAS language, not statistical theory.

Topics include: testing experimental assumptions (PROCs UNIVARIATE and PLOT); independent and paired t-tests (PROC T-TEST); nonparametric tests (PROC NPAR1WAY); use of PROCs CORR, ANOVA, GLM, REG, FREQ, and CATMOD in various applications, including one-way analysis of variance, multiple comparisons, factorial designs, manova, analysis of covariance, methods of stepwise regression, repeated measures designs, partial correlation, categorical data analysis, and logistic regression. A summary of multivariate analysis techniques such as factor analysis and cluster analysis (PROCs FACTOR, CLUSTER, etc.) will also be presented.

Each procedure is examined in the context of sample data. Discussion will concentrate on the types of situations that SAS can handle, available options, and output interpretation. The duration of this course is 10 hours.

Prerequisite: Introduction to SAS, or equivalent experience with SAS.

Intermediate SAS - Data Processing

This course deals with the data processing aspects of SAS. The use of SAS for processing data is demonstrated using a combination of lectures and hands-on practice with sample problems.

Topics include: SAS INFORMATs and FORMATs; pointer controls; DATA step control structures such as DO, LINK, and SELECT; special functions; recoding data using PROC FORMAT; reducing data using PROC SUMMARY; producing reports using PROC PRINT and PROC TABULATE; dealing with external files using INPUT and PUT; importing dBASE and Lotus files using PROC DBF and PROC DIF; rearranging data with DATA steps and PROC TRANSPOSE; portability considerations including SAS Version 5 and Version 6 differences, PROC CPORT and PROC CIMPORT, and methods of transferring data; data set handling using MERGE, UPDATE, POINT, and conditional use of the SET statement.

These topic areas are explained and expanded on through the use of sample data, SAS, dBASE, and Lotus on the PC. The duration of this course is 10 hours.

Prerequisite: Introduction to SAS, or equivalent experience with SAS.

If you would like more information about these and other courses, please contact Irene Rosiecki at 978-4565.

ASYST and ASYSTANT - Data Acquisition and Analysis Software

Andrzej Pindor
apindor@vm.utcs.utoronto.ca

In November, I attended a one-day seminar about ASYST and ASYSTANT software. Held in Toronto, the seminar was organized by DigiDyne Inc., a company which markets a wide variety of computer software and hardware products. An ASYST expert from Keithley Instruments (the company which owns ASYST Software Technologies, Inc., manufacturer of ASYST and ASYSTANT), conducted the seminar. Unlike many seminar leaders who are sales representatives with little practical knowledge of the product, this presenter had hands-on experience and could answer 90% of the questions from the audience.

ASYST and ASYSTANT attempt to provide a complete environment for PC-based engineering and scientific applications. They can collect data and control instruments, and also have considerable data analysis capabilities and powerful graphics for data presentation. The main difference between ASYST and ASYSTANT is that ASYSTANT is menu-driven. This makes ASYSTANT easier to use, but at the same time eliminates the flexibility offered by the command language of ASYST. The focus of this article will be on ASYST, with comments about ASYSTANT where applicable.

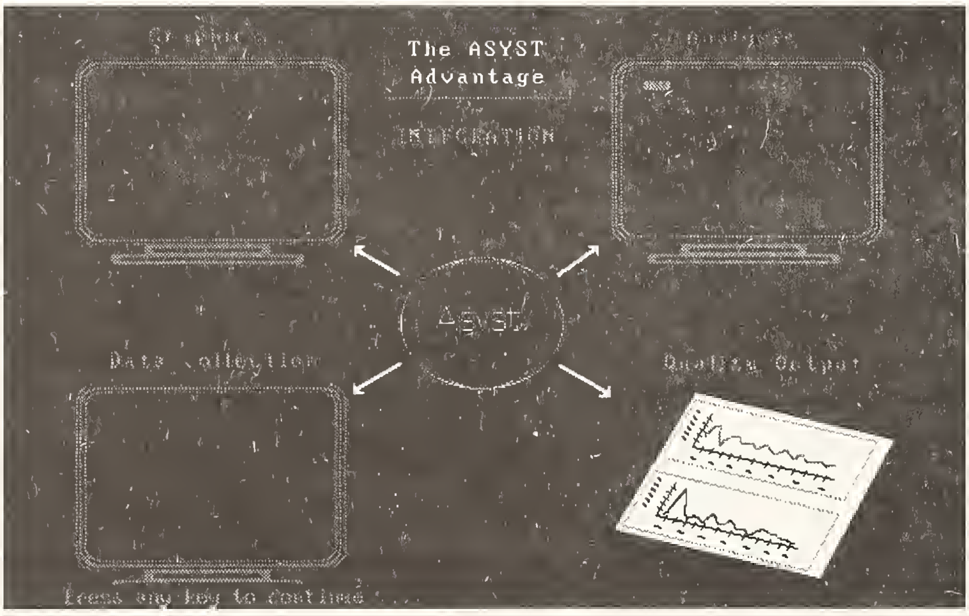
The main capabilities of ASYST include analog-to-digital (A/D) and digital-to-analog (D/A) data acquisition and control; IEEE-488/GPIB and RS-232 instrument control; data manipulation and analysis; and on-line graphics. These capabilities are illustrated schematically in *Figure 1*.

Data Acquisition

ASYST has built-in support for a wide variety of A/D data acquisition hardware, whether it comes as a plug-in or an external board. The supported boards offer up to 304 A/D channels, throughput up to 20MHz, resolution of 8 to 16 bits, and gain (i.e. the ratio between the output and input signals of a device) of up to 2000. The most important feature of ASYST is its multitasking capability, which allows, for example, data input/output in the background, with simultaneous graphics and analysis in the foreground.

GPIB and RS-232 Instrument Control

General Purpose Interface Bus (GPIB) is a highly standardized



Press any key to continue ....

Figure 1

scheme (developed by Hewlett-Packard) to interface computers with laboratory instruments. ASYST provides a full list of commands to manipulate a GPIB, allowing the PC to be the main controller. Transfer rates accessible with GPIB cards can be as high as one megabyte per second. ASYST also provides a comprehensive list of RS-232 commands for complete control over the serial port.

Data Manipulation and Analysis

ASYST has a wide variety of numerical and statistical functions. Statistical functions range from basic statistics to analysis of variance (two-way ANOVA). Special functions available include gamma, beta, Bessel and spherical Bessel, elliptic integral and error function, *plus* a variety of matrix operations. Even a differential equations solver is included. It is very simple to perform tasks such as data smoothing, peak detection, curve fitting or Fast Fourier Transforms (FFT). Although ASYST essentially focusses on performing analyses on collected experimental data, the richness of its programming language allows you to do fairly involved calculations as well. In the case of ASYSTANT, you are limited to what its menus offer, but there is a lot from which to choose. One problem which may arise when programming in ASYST is that its programming language uses Forth's reverse Polish notation, which may feel awkward to many people. Both ASYST and ASYSTANT can read data files in many different formats, and in the case of ASYST, any type of file can be handled since it can read a file one byte at a time.

Graphics

The graphics capabilities of ASYST and ASYSTANT are quite impressive. You can either rely on automatic plotting (with default scaling, axes, etc.), or you can customize your plots. You have complete control over the plot appearance, from the size of ticks to data position, from curve colour to axis size. Logarithmic axes are, of course, available and any number of plots can be superimposed. Graphs can be handled interactively: e.g., a portion of the graph can be selected and zoomed in or out, a selected portion of a curve can be integrated or differentiated or manipulated in some other way (for instance, by taking an FFT). Since you can define several viewports on a screen, you can see simultaneous results of all these manipulations (see *Figure 2*). A nice feature of the package is SCROLLER, which allows you to view, graphically, the contents of a data file in an interactive fashion: forwards, backwards, frozen at a chosen point, zoomed in, etc. Three-dimensional plots can be viewed from different angles, although the algorithm used for this purpose is somewhat limited. Contour plots, pie charts and bar charts are available, and there are no problems with error bars. As mentioned above, due to the multitasking capability of ASYST, data can also be plotted in real time as they arrive from instruments.

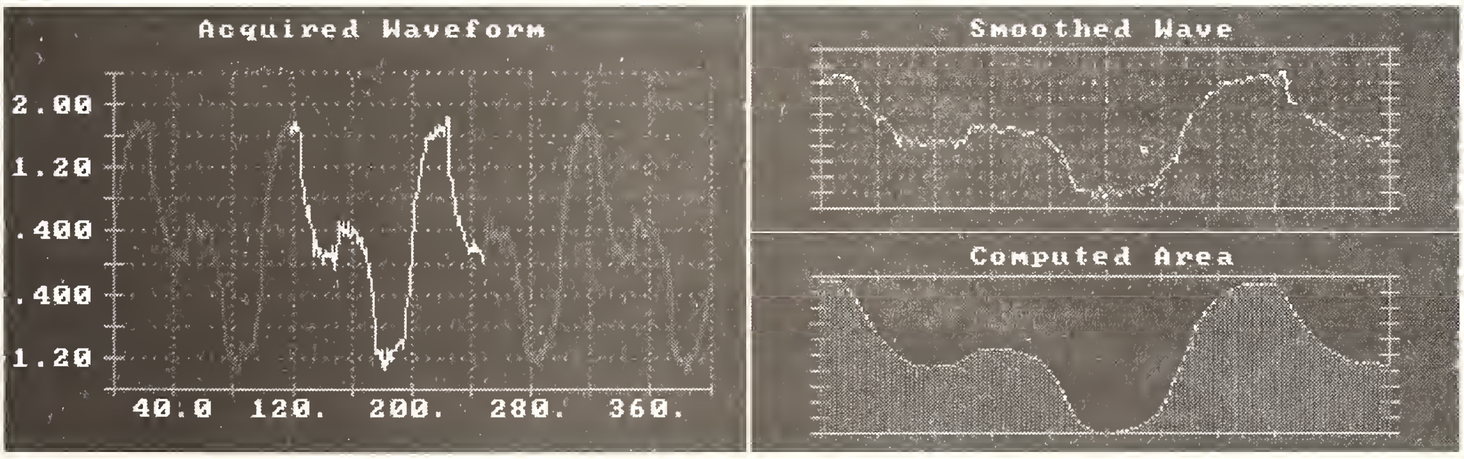


Figure 2

ASYST is divided into four modules: Module 1, which consists of Base System and RS232 Interfacing; Module 2: Analysis, Statistics, and Graphics; Module 3: Data Acquisition; and Module 4: GPIB interfacing. ASYSTANT is available in three varieties: ASYSTANT (the Scientific Number Cruncher), ASYSTANT PLUS (with Data Acquisition added), and ASYSTANT GPIB (ASYSTANT with GPIB interfacing).

Demonstration diskettes of the products were given to the participants, so if anyone is interested in examining them, please call Andrzej Pindor at 978-5045. Copies of demonstration diskettes are also available.

Hardware requirements:

IBM PC/XT/AT or 100% compatible, including IBM PS/2 and 80386 computers in real mode;
DOS 2.0 or higher;
Intel 8087, 80287 or 80387 math coprocessor chip;
640 RAM (512 is sufficient for ASYSTANT);
25 pin standard printer port (a version of ASYSTANT which has no data acquisition capabilities does not require it);
hard disk and one floppy drive;
one of the following graphics boards: IBM CGA, EGA, VGA or 100% compatible Hercules monochrome graphics adapter, AT&T high resolution graphics card (monochrome only).

Pricing:

ASYST (modules 1,2,3,4)	US$	2419
ASYSTANT	US$	310
ASYSTANT GPIB	US$	733
ASYSTANT PLUS	US$	1049

Vendor:

DigiDyne Inc,
266 Galaxy Blvd.,
Etobicoke, Ont.,
M9W 5R8
(416) 674-0444

Derive Keeps on Improving

Andrzej Pindor
apindor@vm.utcs.utoronto.ca

In the March 1989 issue of *ComputerNews*, I reviewed version 1.14 of **Derive**, a small but friendly symbolic manipulation package. Since that time, the package has undergone several upgrades to its present version, 1.5. The following is a summary of the major features added to the program since version 1.14:

- A function for generating a vector or matrix from an expression evaluated at a sequence of points.
- Improved simplifications of expressions involving fractional powers of numbers.
- The ability to compute the average, root mean square, and standard deviation of the elements of a vector or a matrix.
- Extension of the equation solver to handle a wider class of equations involving trigonometric and transcendental functions.

- A function for determining the least-squares best fit of a parametrized expression to a set of data points.
- Functions for computing the cross and outer products of two vectors.
- Differential vector calculus functions for finding gradients, divergences, Laplacians and curls.
- Integral vector calculus functions for finding scalar and vector potentials and Jacobians.
- Functions for finding arc lengths, surface areas and volumes of revolution, Fourier series approximations and Laplace transforms.
- Greatly expanded class of expressions for which the analytic integrator can find a closed form antiderivative.
- Functions defining higher mathematical functions including exponential integrals, Fresnel integrals, Bessel functions, hypergeometric functions, elliptic integrals, Chebychev polynomials, zeta functions, etc.

Users who would like to examine **Derive** to find out if it meets their requirements may do so at UTCS. Contact Andrzej Pindor at 978-5045 in advance to arrange an appointment.

MathStation – Technical Computing Environment for UNIX Machines

Andrzej Pindor
apindor@vm.utcs.utoronto.ca

MathSoft, manufacturer of MathCAD, has developed a visually similar but much more powerful product for UNIX workstations: MathStation. While I was evaluating Version 1.0, a new improved version was released, so I'll postpone the full review of the product until I have seen the new version. But just to whet your appetite, here is an example of a pixel graphic created with MathStation, together with the corresponding MathStation program.

```
c,z ∈ complex
c := .4+0.8i        z := 0+0.i
do
   invoke startpix(2,450,450)
   for k := 1 to 400 do
      for j :=  1 to 400 do
         z := -1.73+.00865·j + -1.73i+.00865i·k
         for n := 1 to 10 do
            z := z^3+z+c
            if |Re(z)| >10∨ |Im(z)| >10∨ |z| >10
               then exit
            .

         .
         if |Re(z)| <10∨ |Im(z)| <10
            then invoke addpix(j+25,k+25,1)
         .

      .

   .
   invoke showpix(2)
end
```

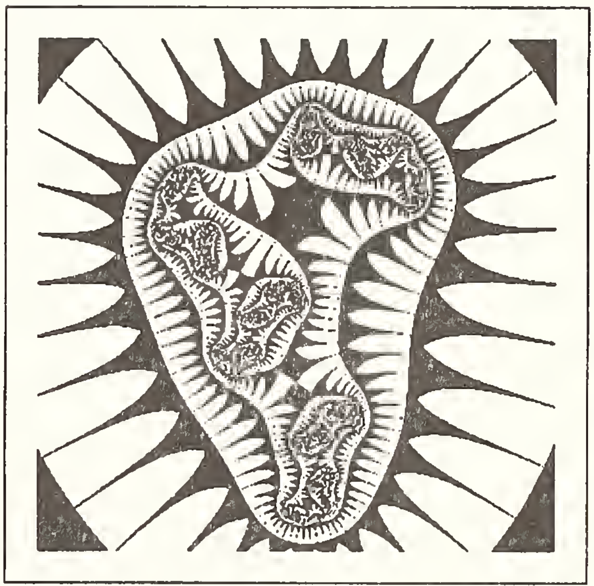


fig. 2

JMP Correction

Sandra Gardner
sgardner@vm.utcs.utoronto.ca

Two figures in *Introducing JMP: Exploratory Data Analysis on the Mac* (*ComputerNews,* November/ December 1989) were not printed correctly. Originally, the graphs were copied into JMP's journal using the MacWrite format option. When these files were copied into other Macintosh applications such as PageMaker and MacDraw, the graphs looked fine on the screen but did not print properly. UTCS has contacted SAS Canada about this problem.

The new versions of these figures are reproduced below. To get them to print correctly, we converted JMP's journal graphs into PICT files and adjusted them manually before printing. *Figure 3* is a leverage plot produced as part of a regression analysis in JMP's **Fit Y by X's** platform. *Figure 5* is a correlation matrix produced by JMP's **Y's by Y's** platform.

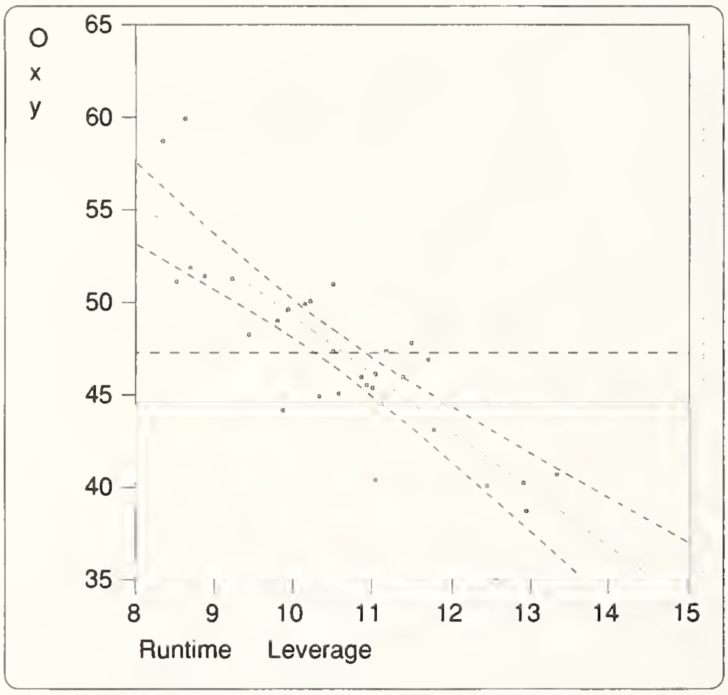


Figure 3

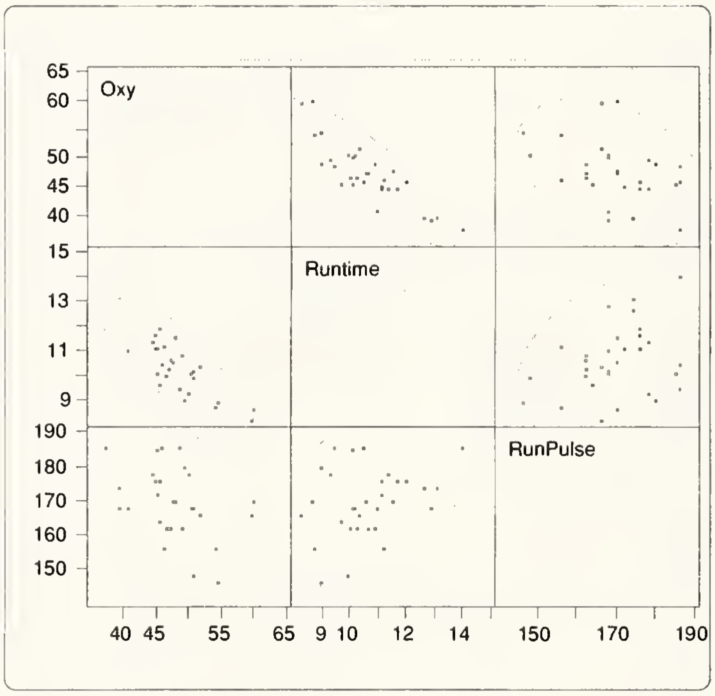


Figure 5

New Microcomputer Courses

Irene Rosiecki
rosiecki@vm.utcs.utoronto.ca

UTCS has added several new microcomputer courses this year. The Intermediate SAS course has been changed to accommodate the growing needs of students. We now offer two Intermediate SAS courses: Intermediate SAS-Statistics focusses on the statistical procedures included in SAS/PC, while Intermediate SAS-Data Processing focusses on the data processing aspects of SAS (see page 31 for course description). Macintosh users will be happy to learn that we now offer a database course for the Macintosh, an introduction to the FoxBASE+ program. The course descriptions here and on page 31 should help you decide which course is best suited to your needs.

Introduction to FoxBASE+/ Mac 2.0

This hands-on course will introduce you to the most commonly used features of FoxBASE+ on the Macintosh. Using both the View Window and the Command Window, you will learn to enter, access, filter, update, organize, and print your database information, as well as define relationships between databases.

Also covered are ways to modify the database structure, to customize FoxBASE+ to suit your needs, and to import and export data from and to other application packages. The duration of this course is 15 hours.

If you would like more information about this and other courses, please contact Irene Rosiecki at 978-4565.

ComputerNews Changes: The 1989 Index and New Site Licenses Section

Patricia Hood
phood@vm.utcs.utoronto.ca

An index for the 1989 issues of *ComputerNews* appears at the back of this issue, beginning on page 46. It replaces, for this issue only, the Microcomputer and Mainframe Software Lists. (The Software Lists will return in the next issue: March 1990.)

Also new to this issue is the Site Licenses listing. These pages will be a permanent part of the "Departments" section. All software site licenses administered by UTCS, and the procedures for obtaining them, are described in this section.

Microcomputer Short Courses

Irene Rosiecki
rosiecki@vm.utcs.utoronto.ca

UTCS offers various noncredit microcomputer courses to faculty, staff, and graduate students of the University of Toronto. These courses cover a number of software programs available for the PC or the Macintosh. Whether you will be typing a thesis on a word processor, or working with spreadsheets, databases, or desktop publishing, we may be able to help you get started.

Our class sizes are small, to allow for much individual attention. Continuing support is available upon completion of a course.

The following is a list of the microcomputer courses taught at UTCS:

Introduction to dBASE IV
Introduction to Desktop Publishing
Introduction to Disk Operating System (DOS)
Electronic Mail Seminar
Excel on the Macintosh
Introduction to FoxBASE+/Mac 2.0
Introduction to HyperCard
Introduction to Lotus 1-2-3
Introduction to PageMaker
ProComm Communications Seminar
Introduction to SAS on the PC
Intermediate SAS – Data Processing
Intermediate SAS – Statistics
Microsoft Word on the Macintosh
Microsoft Word on the PC
Introduction to WordPerfect 5.0
Advanced WordPerfect 5.0 Topics
Introduction to WordPerfect 5.0 for 4.2 Users

To find out about course dates and registration procedures, or to book a place in any of these courses, please contact Irene Rosiecki at 978-4565. Courses are filled on a first-come, first-served basis. The more popular courses fill up quickly, but waiting lists are maintained in case of cancellations.

Documents at UTCS

Vendor-produced documentation may be ordered through the UTCS Information Office, Room 201, 4 Bancroft Avenue. UTCS documents and selected vendor documents are also stocked there for purchase. For more information on prices, call 978-4990. Whenever feasible, documents are made available online, and users are encouraged to print their own copies. On the VM machine, a special command has been provided for this purpose.

To print online documents on:

IBM VM/CMS	***GP UNIX***
Type "help document"	Use *ipr* command

The following examples relate to the table below. The document to be printed is the UTCS Guide to Census Tapes, called CENSUS LISTING on CMS and /usr/doc/utcs/census on GP UNIX. <RETURN> means RETURN or ENTER key.

```
CMS:       document <RETURN> <RETURN>
           laser census listing (forms yxle <RETURN>

GP UNIX:   nohup ipr -8p -fyxle /usr/doc/utcs/census & <RETURN>
```

UTCS Documents in hardcopy

New:

UTCS Rate Schedule (Commercial)
UTCS Rate Schedule (External)
UTCS Rate Schedule (Internal)

Previously announced:

Academic's Guide to Microcomputer Systems
Character Sets for Highspeed Printing
UTCS GUIDE TO PRODUCTS AND SERVICES: Introduction
UTCS GUIDE TO PRODUCTS AND SERVICES: Basics
UTCS GUIDE TO PRODUCTS AND SERVICES: Accounting
UTCS Catalogue: Numerical Products
UTCS Catalogue: Statistics Products
UTCS Catalogue: Text Products
UTCS Guide to Census Tapes
UTCS Guide to Kermit
UTCS Guide to Micro File Transfer Service
UTCS Guide to Text Processing on GP UNIX

UTCS Documents online

	CMS LISTING	GP UNIX	Forms Code
Recently Updated:			
UTCS Guide to Highspeed Printing	PRINT		*
UTCS Guide to VM/CMS	CMSGD		*
UTCS Guide to WScript	WSCRIPT		*
Recently Removed:			
UTCS Guide to Scribe			
UTCS Guide to TFW.MAK in Scribe			
Previously announced:			
UTCS GUIDE TO PRODUCTS AND SERVICES: Introduction	INTRO	/usr/doc/utcs/intro	*
UTCS GUIDE TO PRODUCTS AND SERVICES: Basics	BASICS	/usr/doc/utcs/basics	*
UTCS Catalogue: Access, Part 1	ACCESS1	/usr/doc/utcs/access1	*
UTCS Catalogue: Access, Part 2		/usr/doc/utcs/access2	*
UTCS Catalogue: Numerical Products	NUMCAT		*
Product-Function List	NUMLIST		BXQD
UTCS Catalogue: Statistics Products	STATCAT		*
Product-Function List	STATLIST		BXQD
UTCS Catalogue: Text Products	TEXTCAT	/usr/doc/utcs/textcat	*
UTCS Guide to BMDP	BMDP		*
UTCS Guide to Census Tapes	CENSUS	/usr/doc/utcs/census	*
Recipes for Using Tapes on VM/CMS	QUIKTAPE		*
UTCS Guide to FORTRAN on VM/CMS	FORTRAN		*
UTCS Guide to GP UNIX		/usr/doc/utcs/gpunix	*

* *Recommended forms code for the 8700 is YXLE unless otherwise stated.*
† *Use the 87set command. Type "help 87set".*

Documents continued

UTCS Documents online continued

	CMS LISTING	GP UNIX	Forms Code
UTCS Guide to Kermit	KERMIT	/usr/doc/utcs/kermit	*
UTCS Guide to Micro Laser Printing Service	MICRLASR		*
UTCS Guide to SAS	SAS		*
UTCS Guide to Series/1 Terminal Use	SERIES		*
3270 Emulation:			
Cybernex APL100 and Volker Craig VC404	CYBER		*
DM1520	DM1520		*
Hardcopy Terminal	HARDCOPY		*
IBM 3101	IBM3101		*
IBM PC Kermit	PCKERMIT		*
SOROC IQ	SOROC		*
VT52	VT52		*
VT100	VT100		*
UTCS Guide to SPSS	SPSS		*
UTCS Guide to Text Processing on GP UNIX		/usr/doc/utcs/text	YXOG

Other Documentation online

Electronic Mail			
A User's Guide to Electronic MAIL	MAILBOOK		YXOC
Kermit			
Kermit Protocol Manual	KERMITPM		YXOE
Kermit User Guide	KERMITUG		YXOF
ProComm			
ProComm Reference Manual	PROCOMM		YXOE
VMBATCH Documents			
VMBATCH User's Guide	VMBATCH		YXOA
VMBATCH Messages and Codes	VMBATMC		YXOA
VMSECURE			
VMSECURE User's Guide	VMSECURE		YXOE
VM Tape Documents			
TapeMap User's Guide and Reference	TAPEMAP		*
VMTAPE Messages and Codes	VMTMSGS		YXOE
VMTAPE User's Guide	VMTUSER		YXOE
Waterloo SCRIPT			
Reference Manual	WSCRPTRF		YXLC
User's Guide	WSCRPTUG		YXLC
Using SCRIPT in MVS/TSO	WSCRPTSO		YXLC
Waterloo SCRIPT and a PostScript Printer	WSCRPTPS		YXLC
Formula Processor Summary	WSCRPTFP		YXLC
GML User's Guide	GMLUG		YXLC
GML Reference Summary	GMLRFSUM		YXLC

** Recommended forms code for the 8700 is YXLE unless otherwise stated.*
† Use the 87set command. Type "help 87set".

Consulting and Enquiries

Applications Support & Advising Supervisor	Alex Nishri	BC214	978-7109
External Marketing Consultant	Ihor Prociuk	BC217	978-6875
Erindale College	Joe Lim	ER2035	828-5311
Information Office	Shirley MacLeod	BC201	978-4990
Account & Access Code Enquiries	Sylvia May	BC101B	978-7148
IBM & Macintosh Maintenance	Kam Mark	BC103	978-5050
Tape Library (Academic Services)	Susan Kovago	MP368	978-7319
Tape Library (Administrative Services)	Miranda Fong	MP368	978-6693
Terminal Service	Rosi Tseu	BC105	978-7087
UTCS Noncredit Short Courses	Irene Rosiecki	BC217	978-4565

Consulting & Advising Services:	978-HELP
CMS, and GP UNIX userids:	ADVISOR
CMS Userid for mail problems:	POSTMSTR
System Status Enquiries (GP UNIX)	978-4318
System Status Enquiries (IBM)	978-7393
Interactive Services 300 (bps)	978-3959
Interactive Services 1200 (bps)	978-3959
Interactive Services 2400 (bps)	978-7239

UTCS Directory

Director:	Dr. Warren Jackson	BC118	978-8948	wcj@vm.utcs.utoronto.ca
Associate Director:	Eugene Siciunas	BC116	978-5058	eugene@vm.utcs.utoronto.ca
Managers:				
Communications &Technical Support	Norman Housley	BC121B	978-4967	norman@vm.utcs.utoronto.ca
Information Centre	Don Gibson	BC217	978-7331	don@vm.utcs.utoronto.ca
Internal Systems Support	Ron Vander Kraats	BC121A	978-4428	rvk@vm.utcs.utoronto.ca
Operations Support	Dr. Bob Chambers	MP350	978-7092	
Systems Support	Bill Lauriston	MP331	978-3579	bill@vm.utcs.utoronto.ca

Committees on Computing

Supercomputer Users' Group at U of T	Chair	Prof. W.R. Peltier	978-2938
Research Board Standing Committee on Computing	Chair	Prof. C.C. Gotlieb	978-2986

Legend

BC = Bancroft Building
ER = Erindale
MP = McLennan Physical Labs

* NetNorth/BITNET/EARN

UTCS Terminal and Advising Sites

Names and Locations

Central Advising Office (CAO), 978-HELP
Engineering Annex (EA, CDF), 11 King's College Road, Rooms 103, 107, 107B, 201, 203
Erindale College (Erin), 828-5339, 3359 Mississauga Road North, Erindale Campus, Rooms 2037, 2039A-B-C, 2045
Robarts, Robarts Library, 130 St. George St., Room 1061A
Sidney Smith (Sidney), 100 St. George St., Rooms 1071, 2105
St.Michael's College, 121 St. Joseph St., Room 107
Trinity College, 6 Hoskin Ave., Room 024
Victoria University, 73 Queen's Park Cres., Room 208

Access Hours

Sites	Hours of Access				Restrictions*	Advising
	Mon-Thurs	Fri	Sat	Sun		
CAO	10:00-18:00	10:00-18:00	closed	closed	Research	978-HELP
CDF	24 hrs	24 hrs	24 hrs	24 hrs	Undergrads	No
EA	24 hrs	24 hrs	24 hrs	24 hrs	None	978-HELP for Research
Erin (2039)Δ	9:00-17:00	9:00-17:00	12:00-16:00	12:00-16:00	Research	Rm 2005
(2045-46-47)	24 hrs	24 hrs	24 hrs	24 hrs	Undergrads	Rm 2005
(235)†	8:00-22:00	8:00-17:00	closed	closed	None	Rm 2046
Robarts	8:30-24:00	8:30-24:00	9:00-22:00	13:00-22:00	None	978-HELP for Research
Sidney	7:00-24:00	7:00-24:00	7:00-24:00	7:00-24:00	None	978-HELP for Research
St.Michael's	24 hrs	24 hrs	24 hrs	24 hrs	None	978-HELP for Research
Trinity	8:00-22:00	8:00-22:00	8:00-22:00	8:00-22:00	None	978-HELP for Research
Victoria	8:30-21:00	8:30-21:00	8:00-13:00	8:00-13:00	None	978-HELP for Research

Sites	Advising Hours
CAO	Monday through Friday, 10:00 - 18:00
Erin	Monday through Friday, 09:00 - 22:00

Legend
* Research includes graduates, faculty, staff.
Δ Key access available.
† Access restricted to building hours.

Computer and Printer Access

Sites	PACX	Printers	CDF/PC Microcomputers
CDF	N	Y	N
EA	Y	Y	N
Erin	Y	Y	N
Robarts	Y	Y	Y †
Sidney	Y	Y	Y††
St.Michael's	Y	Y	Y††
Trinity	Y	Y*	Y††
Victoria	Y	Y*	Y††

(Y=yes, N=no)

* CDF/PC only † NEC †† TI/PC

UTCS Services

UTCS Centrally Owned and Managed

Systems

IBM VM/CMS
Technical Assistance: 978-6602

- General Purpose Timesharing environment
- Hub of the NetNorth network with access to BITNET, EARN and the Internet
- 4381-R02 processor with 32 megabytes of memory
- CP operating system, VM/SP HPO R5
- CMS timesharing system, VM/SP Release 5
- FTP and TELNET access to the campus ethernet, as well as Internet
- RSCS spooling system, Release 2.3

GP UNIX
Technical Assistance: 978-8853

- General Purpose Timesharing under SUN UNIX 3.2
- SUN 3/280, 8 megabytes of memory
- access to Linotronic typesetter
- offers a sophisticated and powerful environment for text processing
- offers a sophisticated programming environment suitable for commercial software development or testing
- full access to USENET, an electronic technical information exchange facility
- offers excellent electronic mail facilities and ability to send or receive mail from most computer networks worldwide, such as UUCPNET, ARPANET, NetNorth, BITNET, CSNET, CDNNET

Services

Communications & Technical Support
Primary Phones: 978-3787, 978-4967

- Communications Group provides communications systems, terminals, modems, data channels: consulting and installation.
- Field Service Group installs and maintains communications and computer systems, particularly IBM PCs, Micro Vaxes, and Macintoshes, on a contract basis or on a cost-per-call basis.
- provides consulting on computer systems technology and installs computer systems
- provides access between the IBM systems and machines using UNIX, VMS and other operating systems. Ethernet, Pronet, and IBM TRN technologies are used over various transmission media including optical fibre. More basic communications techniques are also used for moderate speed links.
- provides consulting on local area networking and installs LANS
- provides access to NetNorth (BITNET), the North American Universities Network; ONET, the Ontario Regional Network; and USENET, the UNIX networking fraternity
- provides gateway to the US Internet
- will provide a communications solution to department needs on a contractual basis

Information Centre
Primary Phone: 978-HELP

- Provides assistance in use of electronic messaging, including use of Local Area Networks (LANS); NetNorth/BITNET/EARN, the world Universities network; CDNNET, the Canadian X.400 network; ARPANET; CSNET; USENET; and other international connections.
- provides advising, consulting and documentation on:
  - command languages, including CMS and UNIX
  - high-level languages, including FORTRAN, and C
  - packages and libraries, including SAS, SPSS, BMDP, IMSL, and NAg
  - editors and formatters, including XEDIT, ed, nroff/troff
- provides general micro support
  - selection consulting for hardware and software
  - Micro Lab for evaluation of hardware and software
  - advice on University discounts
  - media conversion and data transfer
  - CD-ROM access to software and information discs
  - offers Micro Laser Printing Service
  - offers 35mm slide production service using Polaroid Palette
  - administers Local Area Network of PCs for Education Facility
  - administers Macintosh Education Facility
- high-quality typesetting
- installs and maintains application packages
- administers site licenses for various software packages
- provides short courses and seminars on the more popular services and software packages

> *The mandate of UTCS is to encourage and support the use of information technologies across campus, and to plan, implement, and operate common-carrier networks and certain appropriate central computer facilities.*

Facilities Managed by UTCS

Administrative Computing

- administrative IMS, DB2, Batch, and TSO
- 3081K processor, 48 megabytes of memory
- MVS/XA operating system

Computer Disciplines Facility/UNIX

SUN 3/280s, 16 megabytes of memory (zero.cdf)
- Computer Science interactive access
- SUN UNIX 4.0.3

SUN 3/280s, 16 megabytes of memory (one.cdf)
- Computer Science interactive access
- SUN UNIX 4.0.3

Computer Disciplines Facility/PC

- 40 NEC computers connected in a Local Area Network
- 66 TI Professional Computers connected in a Local Area Network
- introductory Computer Science instruction
- MS-DOS with Turing environment

Erindale College Systems

VAX 8200, 8 megabytes of memory
- instructional access using VMS
- research access

VAX-11/750, 5 megabytes of memory
- instructional access using UNIX (Berkeley UNIX 4.3BSD)

Institutional Relations System

VAX-11/750, 8 megabytes of memory
- database services to the owner departments using VMS

EPAS Facility

- 4361-5 processor, 16 megabytes of memory
- general VM/CMS services to the owner departments

Ontario Centre for Large Scale Computation (OCLSC)

- Cray Research Inc. X-MP/24
- 2 processors, 4 megawords main memory
- solid state disk (SSD) with 64 megawords of storage
- COS 1.17 operating system
- VAX 8350 + MicroVAX II and VAX750 provide VMS front-end services

UTCS Site Licenses

UTCS administers a number of software site licenses available to the University of Toronto community. (Usually, this means faculty, staff, and graduate students, though some licenses apply to undergraduate students also. See "Restrictions" in the table below.) The licenses provide a variety of software at much-reduced cost. The majority of the licenses must be renewed each year. Most are terminated when you leave U of T.

Each license has a contract that you must complete. It outlines your responsibilities and any limitations in the use of the software. Except for ProComm, the contracts and software are available from the UTCS Information Office, 4 Bancroft Avenue, Room 201. ProComm is available from the UTCS Advising Office, 978-HELP. To qualify as a member of the U of T community, you must provide a valid Employee number or Student number.

The table below describes the available site licenses. The Restrictions column specifies who may purchase the license. If the restriction is U of T Research, the payment must come from research money. The Diskettes column describes how you actually receive the software. Large packages, like SAS and SPSS, require that you borrow the diskettes, install the software, and return the diskettes. Smaller packages, consisting of up to five diskettes, either require you to bring your own diskettes or include the costs of the UTCS-supplied diskettes in the license fee.

For more detailed information about these site licenses, telephone the UTCS Information Office at 978-4990.

Site Licenses at UTCS

Product Name	*Archivist*	*Chaos in the Classroom I: Maps and Bifurcations*	*Procomm*
System	PC; Text management	PC;	PC; Communications
Restrictions	Faculty, Staff, Graduate Students	Faculty, Staff, Graduate Students	Faculty, Staff, Graduate Students, Undergraduate
Cost	$40	$12	Free
License Period	One-time fee	One-time fee	N/A
Diskettes	One 5.25"; bring own	One 5.25" or one 3.5"; bring own	Two 5.25"; bring own
Documentation Available at UTCS	No	Yes	On disk; part of package

Product Name	*QuickMail*	*SAS/PC*	*SAS/PC network*
System	Mac; Electronic mail	PC; Statistical analysis	PC; Statistical analysis
Restrictions	Faculty, Staff	Faculty, Staff, Graduate Students, Undergraduate	Faculty, Staff, Graduate Students
Cost	$25 per user	BASE/STAT/GRAPH: $70; FSP module: $10; IML module: $20; ETS module: $35.	$35 per station
License Period	One-time fee	July 1-June 30	July 1-June 30
Diskettes	One 3.5"; bring own	Deposit $25 per box; 6-10 boxes	
Documentation Available at UTCS	No	Yes	Yes

Site Licenses at UTCS continued

Product Name	***SAS/UNIX***	***SPSS/PC***	***SYSTAT***
System	UNIX; Statistical analysis	PC; Statistical analysis	Mac; Statistical analysis
Restrictions	Faculty, Staff, Graduate Students	Research	Faculty, Staff, Graduate Students
Cost	$150 BASE; $50 ea. FSP, IML modules	$100	$100
License Period	July 1-June 30	Nov 1-Oct 31	July 1-June 30
Diskettes	Tape cartridge	Deposit $25 per box; 2-3 boxes	Five 800KB 3.5" diskettes; bring own
Documentation Available at UTCS	Yes	No	Yes

Product Name	***WATCOM C***	***WATFOR-77***	***WordPerfect***
System	PC; C compiler	PC; FORTRAN compiler	PC
Restrictions	Research	Research	Faculty, Staff
Cost	$35	$35 [$35 WATFOR-87 (math co-processor)]; Add. $5 GKS (Graphics Kermal System)	New: $65 Upgrade: $10
License Period	July 1-June 30	July 1-June 30	One time fee
Diskettes	Ten 5.25" diskettes; bring own	Included in license fee	Deposit $25 per box; 1 box
Documentation Available at UTCS	Yes	Yes	Yes

CNews Index 1989

	Keyword	*Article*	*Issue*	*Month*	*Page*
	386	State of the 386's (The)	254	April	15
	486	IBM Announces 486 Power Platform	257	September	17
	Accounting News	UTCS Debit Memo Policy	252	January/February	18
A	**Adobe**	Fonts and Microsoft Windows	255	May/June	10
		Fonts: An Overview	255	May/June	1
	Algebraic Computing	GAMS	258	October	1
		Numerical and Scientific Software for Microcomputers	252	January/February	21
	Annual Plan	Excerpts from the 1989/90 UTCS Annual Plan	254	April	1
	Apple	(see Macintosh)			
	AppleTalk	AppleTalk Gateway Improves Computer Communications	252	January/February	3
		Computer Networks	254	April	17
	ARCHIVIST	ARCHIVIST Now Available at UTCS	252	January/February	25
	ARPAnet	Computer Networks	254	April	17
		Let's Talk About It: External Networking Developments I	252	January/February	1
	ARPP	Electronic Embryo (The)	252	January/February	19
		Works of ARPP	259	November/December	3
B	Backups	TLC Legacy 150 x^2 Tape Backup	255	May/June	33
	Bitstream	Bitstream Fontware	255	May/June	9
		Fonts and Microsoft Windows	255	May/June	10
		Fonts: An Overview	255	May/June	1
		New Font Alternatives	255	May/June	8
	Bookshelf	Textbases and Resources for Humanities Computing	252	January/February	13
	C	WATCOM C Version 7.0	256	July/August	15
C		WATCOM License Renewal	255	May/June	26
	CAI	Electronic Embryo (The)	252	January/February	19
	Cartography	PICT Map Collection for the Macintosh	255	May/June	25
	CD-ROM	Mega CD-ROM: A Collection of Public Domain Software for the Macintosh	255	May/June	40
		Textbases and Resources for Humanities Computing	252	January/February	13
	Census	Jean Talon Project (The): A Gift to the Twenty-First Century	253	March	10
	Chaos	More Chaos on Your Computer	258	October	4
		Numerical and Scientific Software for Microcomputers	252	January/February	21
	CHEMICAL/CHEMVIEW	Numerical and Scientific Software for Microcomputers	252	January/February	21
	CMS	NAg Interactive Help System on CMS	257	September	24
		VM/SP Upgrade	257	September	21
	Commodore	Review: Commodore PC40-III and Packard Bell PACKMATE 12	254	April	27
	Communication(s)	AppleTalk Gateway Improves Computer Communications	252	January/February	3
		Comparing NetNorth and ONet	254	April	24
		Do You Need A Right Hand Man	255	May/June	34
		Free Electronic Mail Demonstration	257	September	19
		Free NetNorth (Electronic Mail) Demo	252	January/February	6
		Gateways from TCP/IP to other Network Protocols	254	April	23
		GP UNIX Mail Change	255	May/June	25
		ProComm Communications Seminar	252	January/February	6
		ProComm Communications Seminar	257	September	20
		QuickMail for the Macintosh	252	January/February	4
	Compaq	Laptops: A Guide to Portable Computers	256	July/August	1

CNews Index 1989

Keyword	*Article*	*Issue*	*Month*	*Page*
C				
Compilers	PRO-C Application Generator	254	April	29
	WATCOM C Version 7.0	256	July/August	15
	WATCOM License Renewal	255	May/June	26
	WATFOR-77 V3.1	258	October	6
Conferences	1989 SIAM Annual Meeting	257	September	28
	Enhancing Our Understanding: "The Dynamic Text" Conference	257	September	295
	Seybold Conference 1989: A Report	259	November/December	23
COREL	COREL DRAW	255	May/June	19
Courses	Microcomputer Courses	252	January/February	26
	Microcomputer Courses	258	October	20
	Microcomputer Short Courses	259	November/December	39
	Noncredit Short Courses	253	March	28
	PC Education Facility Upgrade	252	January/February	7
	ProComm Communications Seminar	252	January/February	6
	ProComm Communications Seminar	257	September	20
CRAY X-MP	Computer Networks	254	April	17
CURVE^{fit}	CURVE^{fit}	258	October	2
D				
Database Managers	ARCHIVIST Now Available at UTCS	252	January/February	25
	MacWorld Products and Highlights	253	March	5
Datapac	UTCS Datapac Access to End	254	April	37
Debit Memo Policy	UTCS Debit Memo Policy	252	January/February	18
DECNET	Let's Talk About It: External Networking Developments I	252	January/February	1
Derive	Numerical and Scientific Software for Microcomputers	253	March	17
DESIGN	Numerical and Scientific Software for Microcomputers	255	May/June	28
Desk Accessories	Outline Applications on the Macintosh	255	May/June	37
Desktop Publishing	A Glimpse at Fontographer: Creating New Alternatives	255	May/June	18
	Fonts and Microsoft Windows	255	May/June	10
	Fonts for WordPerfect 5.0	255	May/June	20
	Fonts on the Macintosh	255	May/June	13
	Fonts: An Overview	255	May/June	1
	New Font Alternatives	255	May/June	8
	PageMaker and Images	259	November/December	34
	Publish it Yourself!	259	November/December	32
	Seybold Conference 1989: A Report	259	November/December	23
Domesday Project	Jean Talon Project (The): A Gift to the Twenty-First Century	253	March	10
DOS	Does My PC Need More Memory for Running SAS?	253	March	20
Dynamical Software	Numerical and Scientific Software for Microcomputers	252	January/February	21
E				
Electronic Mail	Comparing NetNorth and ONet	254	April	24
	Computer Networks	254	April	17
	Free Electronic Mail Demonstration	257	September	19
	Free NetNorth (Electronic Mail) Demo	252	January/February	6
	GP UNIX Mail Change	255	May/June	25
	QuickMail for the Macintosh	252	January/February	4
	UTCS Datapac Access to End	254	April	37
	UTCS Dial-In Facilities	254	April	37
Equation Solving	Numerical and Scientific Software for Microcomputers	255	May/June	28
Ethernet	AppleTalk Gateway Improves Computer Communications	252	January/February	3

CNews Index 1989

	Keyword	*Article*	*Issue*	*Month*	*Page*
E/F	Excel	Can a Computer Add?	255	May/June	39
	FAX	FAX Service Now Available at UTCS!	257	September	18
	Fontographer	A Glimpse at Fontographer: Creating New Alternatives	255	May/June	18
	Fonts	A Glimpse at Fontographer: Creating New Alternatives	255	May/June	18
		Bitstream Fontware	255	May/June	9
		Fonts and Microsoft Windows	255	May/June	10
		Fonts for WordPerfect 5.0	255	May/June	20
		Fonts on the Macintosh	255	May/June	13
		Fonts: An Overview	255	May/June	1
		New Font Alternatives	255	May/June	8
	FORTRAN	Numerical and Scientific Software News	259	November/December	20
		Site License for NAg Fortran Library	259	November/December	18
		WATFOR-77 V3.1	258	October	6
G	GAMS	GAMS	258	October	1
	GAUSS	Numerical and Scientific Software for Microcomputers	252	January/February	21
		Numerical and Scientific Software News	259	November/December	20
	GISIS	Jean Talon Project (The): A Gift to the Twenty-First Century	253	March	10
	GMK3	Checking Your Writing Electronically	252	January/February	16
	Gopher	Beyond Word-Processing - Searching and Analysing Text	252	January/February	11
		Textbases and Resources for Humanities Computing	252	January/February	13
	GP UNIX	GP UNIX Mail Change	255	May/June	25
	Grammatik III	Checking Your Writing Electronically	252	January/February	16
	Graphics	COREL DRAW	255	May/June	19
		Electronic Embryo (The)	252	January/February	19
		Graphics and WordPerfect	255	May/June	23
		Harvard Graphics Now at UTCS	254	April	29
		Image	256	July/August	6
		ImageStudio 1.5: Much More than MacPaint	256	July/August	8
		MacWorld Products and Highlights	253	March	5
		PICT Map Collection for the Macintosh	255	May/June	25
		SYGRAPH - SYSTAT's Graphics Bonus	253	March	12
H	**Hardware**	35mm Slides for Macintosh Users	257	September	19
		A Mouse in Hand	253	March	23
		IBM Announces 486 Power Platform	257	September	17
		Laptops: A Guide to Portable Computers	256	July/August	1
		Laptops: Comparing Models	256	July/August	2
		Laptops: Quick Points to Ponder Before Purchasing	256	July/August	5
		Macintosh Models	258	October	16
		Macintosh Portable (The) and Macintosh IIci	259	November/December	1
		MacWorld Products and Highlights	253	March	5
		MacWorld: Multimedia Computing	258	October	12
		Memory Upgrades for the Macintosh	255	May/June	35
		NeXT	253	March	1
		Of Mice and Leaping Einsteins	253	March	26
		Review: Commodore PC40-III and Packard Bell PACKMATE 12	254	April	27
		State of Even Faster Machines (The)	257	September	17
		State of the 386's (The)	254	April	15

CNews Index 1989

Keyword	*Article*	*Issue*	*Month*	*Page*	
Harvard Graphics	Harvard Graphics Now at UTCS	254	April	29	
Hewlett Packard	Laptops: Comparing Models	256	July/August	2	*H*
Humanities Computing	Enhancing Our Understanding "The Dynamic Text" Conference	257	September	295	
	Textbases and Resources for Humanities Computing	252	January/February	13	
Hypermedia	MacWorld: Multimedia Computing	258	October	12	
IBM	A Mouse in Hand	253	March	23	
	Computer Networks	254	April	17	*I*
	IBM Announces 486 Power Platform	257	September	17	
	State of the 386's (The)	254	April	15	
Image	Image	256	July/August	6	
ImageStudio	ImageStudio 1.5: Much More than MacPaint	256	July/August	8	
IMSL	Numerical and Scientific Software for Microcomputers	252	January/February	21	
	Numerical and Scientific Software News	259	November/December	20	
Information	Information Centre Talk	256	July/August	10	
	Macintosh Users - Take Note(s)!	252	January/February	20	
	Putting it Together. . . A Guide to UTCS	257	September	1	
INTERNET	AppleTalk Gateway Improves Computer Communications	252	January/February	3	
Jean Talon Project	Jean Talon Project (The): A Gift to the Twenty-First Century	253	March	10	
JMP	Introducing JMP: Exploratory Data Analysis on the Mac	259	November/December	7	*J/K*
Kinetics FastPath	AppleTalk Gateway Improves Computer Communications	252	January/February	3	
Laptops	Laptops: A Guide to Portable Computers	256	July/August	1	
	Laptops: Comparing Models	256	July/August	2	*L*
	Laptops: Quick Points to Ponder Before Purchasing	256	July/August	5	
Laser Printers	New Font Alternatives	255	May/June	8	
Legacy 150x^2	TLC Legacy 150 x^2 Tape Backup	255	May/June	33	
Licenses	PRO-C Application Generator	254	April	29	
	Site License for NAg Fortran Library	259	November/December	18	
	SPSS News	259	November/December	17	
LISTSERVE	Attention LISTSERVE and Network Users: UTORONTO is changing to UTORVM	253	March	9	
LOCKIT	LOCKIT: Affordable PC Security	254	April	28	
LOGIT	Numerical and Scientific Software for Microcomputers	255	May/June	28	
Logitech	Of Mice and Leaping Einsteins	253	March	26	
Lotus 1-2-3	Can a Computer Add?	255	May/June	39	
	Spreadsheets for Science and Engineering	259	November/December	14	
Macintosh	35mm Slides for Macintosh Users	257	September	19	
	A Glimpse at Fontographer: Creating New Alternatives	255	May/June	18	*M*
	A Mouse in Hand	253	March	23	
	AppleTalk Gateway Improves Computer Communications	252	January/February	3	
	Electronic Embryo (The)	252	January/February	19	
	Fonts on the Macintosh	255	May/June	13	
	Image	256	July/August	6	
	ImageStudio 1.5: Much More than MacPaint	256	July/August	8	
	Introducing JMP: Exploratory Data Analysis on the Mac	259	November/December	7	
	Macintosh Models	258	October	16	
	Macintosh Portable (The) and Macintosh IIci	259	November/December	1	
	Macintosh Users - Take Note(s)!	252	January/February	20	
	MacWorld Products and Highlights	253	March	5	

CNews Index 1989

M

Keyword	Article	Issue	Month	Page
Macintosh	MacWorld: Multimedia Computing	258	October	12
	Mathematica: A Review	254	April	35
	Mega CD-ROM: A Collection of Public Domain Software for the Macintosh	255	May/June	40
	Memory Upgrades for the Macintosh	255	May/June	35
	Microsoft Word 4.0 for the Macintosh	259	November/December	30
	Numerical and Scientific Software News	257	September	23
	Outline Applications on the Macintosh	255	May/June	37
	PICT Map Collection for the Macintosh	255	May/June	25
	QuickMail for the Macintosh	252	January/February	4
	Works of ARPP	259	November/December	3
Magazines	Macintosh Users - Take Note(s)!	252	January/February	20
Mainframes	NAg Interactive Help System on CMS	257	September	24
	SAS on the SIJN Workstation: An Update	257	September	22
	SAS under UNIX	254	April	31
	UTCS Datapac Access to End	254	April	37
	UTCS Dial-In Facilities	254	April	37
	VM/SP Upgrade	257	September	21
Maps	PICT Map Collection for the Macintosh	255	May/June	25
Mark13	Numerical and Scientific Software for Microcomputers	256	July/August	12
MathCAD	Numerical and Scientific Software for Microcomputers	252	January/February	21
	Numerical and Scientific Software for Microcomputers	256	July/August	12
	Numerical and Scientific Software News	257	September	23
	Numerical and Scientific Software News	259	November/December	20
Mathematica	Mathematica: A Review	254	April	35
	Numerical and Scientific Software News	257	September	23
Mathematical Toolboxes	Numerical and Scientific Software for Microcomputers	252	January/February	21
	Numerical and Scientific Software for Microcomputers	256	July/August	12
	Numerical and Scientific Software News	257	September	23
	Numerical and Scientific Software News	259	November/December	20
MatLab	Numerical and Scientific Software for Microcomputers	252	January/February	21
	Numerical and Scientific Software News	257	September	23
Medical Computing	Electronic Embryo (The)	252	January/February	19
Memory	Does My PC Need More Memory for Running SAS?	253	March	20
	IBM Announces 486 Power Platform	257	September	17
	Memory Upgrades for the Macintosh	255	May/June	35
	State of Even Faster Machines (The)	257	September	17
Micro-OCP	Beyond Word-Processing - Searching and Analysing Text	252	January/February	11
Microsoft	A Mouse in Hand	253	March	23
	Can a Computer Add?	255	May/June	39
	Fonts and Microsoft Windows	255	May/June	10
	Microsoft Word 4.0 for the Macintosh	259	November/December	30
	Of Mice and Leaping Einsteins	253	March	26
	Publish it Yourself!	259	November/December	32
	Textbases and Resources for Humanities Computing	252	January/February	13
	What Makes Microsoft Word 5.0 Better than Word 4.0?	258	October	7
Mouse	A Mouse in Hand	253	March	23
	Of Mice and Leaping Einsteins	253	March	26

CNews Index 1989

M/N

Keyword	Article	Issue	Month	Page
Multimedia	MacWorld: Multimedia Computing	258	October	12
MuMath	Numerical and Scientific Software for Microcomputers	253	March	17
NAg	NAg Interactive Help System on CMS	257	September	24
	Numerical and Scientific Software for Microcomputers	256	July/August	12
	Numerical and Scientific Software for Microcomputers	256	July/August	12
	Site License for NAg Fortran Library	259	November/December	18
NEC	Laptops: A Guide to Portable Computers	256	July/August	1
	Laptops: Comparing Models	256	July/August	2
NetNorth	Comparing NetNorth and ONet	254	April	24
Networks	AppleTalk Gateway Improves Computer Communications	252	January/February	3
	Attention LISTSERVE and Network Users: UTORONTO is changing to UTORVM	253	March	9
	Comparing NetNorth and ONet	254	April	24
	Computer Networks	254	April	17
	Computer Networks and TCP/IP	254	April	21
	Free Electronic Mail Demonstration	257	September	19
	Free NetNorth (Electronic Mail) Demo	252	January/February	6
	Gateways from TCP/IP to other Network Protocols	254	April	23
	GP UNIX Mail Change	255	May/June	25
	Let's Talk About It: External Networking Developments I	252	January/February	1
	MacWorld Products and Highlights	253	March	5
	NAg Interactive Help System on CMS	257	September	24
	SAS under UNIX	254	April	31
	UTCS Datapac Access to End	254	April	37
	UTCS Dial-In Facilities	254	April	37
	VM/SP Upgrade	257	September	21
NeXT	NeXT	253	March	1
	Textbases and Resources for Humanities Computing	252	January/February	13
NSFNet	Let's Talk About It: External Networking Developments I	252	January/February	1

O

OED	Textbases and Resources for Humanities Computing	252	January/February	13
ONet	Comparing NetNorth and ONet	254	April	24
	Let's Talk About It: External Networking Developments I	252	January/February	1
Oxford English Dictionary	Textbases and Resources for Humanities Computing	252	January/February	13

P

Packard Bell	Review: Commodore PC40-III and Packard Bell PACKMATE 12	254	April	27
PACKMATE 12	Review: Commodore PC40-III and Packard Bell PACKMATE 12	254	April	27
PageMaker	PageMaker and Images	259	November/December	34
PC	ARCHIVIST Now Available at UTCS	252	January/February	25
	COREL DRAW	255	May/June	19
	Does My PC Need More Memory for Running SAS?	253	March	20
	Features of SAS/IML on a Microcomputer	254	April	32
	Good News, WordPerfect Users, WordPerfect 5.1 is Coming	259	November/December	28
	Harvard Graphics Now at UTCS	254	April	29
	IBM Announces 486 Power Platform	257	September	17
	LOCKIT: Affordable PC Security	254	April	28
	More Chaos on Your Computer	258	October	4
	Numerical and Scientific Software News	257	September	23
	PC Education Facility Upgrade	252	January/February	7
	SAS/ETS Now Available for the PC	257	September	22

CNews Index 1989

	Keyword	Article	Issue	Month	Page
P	**PC**	SAS/FSP - What's in it for Me?	259	November/December	11
		SAS/PC License Renewal	255	May/June	26
		SAS/PC NEWS	254	April	30
		State of Even Faster Machines (The)	257	September	17
		State of the 386's (The)	254	April	15
	PC40-III	Review: Commodore PC40-III and Packard Bell PACKMATE 12	254	April	27
	PICT	PICT Map Collection for the Macintosh	255	May/June	25
	Portable Computers	Laptops: A Guide to Portable Computers	256	July/August	1
		Laptops: Comparing Models	256	July/August	2
		Laptops: Quick Points to Ponder Before Purchasing	256	July/August	5
		Macintosh Portable (The) and Macintosh IIci	259	November/December	1
	PostScript	A Glimpse at Fontographer: Creating New Alternatives	255	May/June	18
		Fonts on the Macintosh	255	May/June	13
		Fonts: An Overview	255	May/June	1
		New Font Alternatives	255	May/June	8
	PRO-C	PRO-C Application Generator	254	April	29
	PROBIT	Numerical and Scientific Software for Microcomputers	255	May/June	28
	ProComm	ProComm Communications Seminar	252	January/February	6
		ProComm Communications Seminar	257	September	20
	Protocols	Gateways from TCP/IP to other Network Protocols	254	April	23
	Public Domain Software	Mega CD-ROM: A Collection of Public Domain Software for the Macintosh	255	May/June	40
		PICT Map Collection for the Macintosh	255	May/June	25
	Publishing	A Glimpse at Fontographer: Creating New Alternatives	255	May/June	18
		Bitstream Fontware	255	May/June	9
		Fonts and Microsoft Windows	255	May/June	10
		Fonts for WordPerfect 5.0	255	May/June	20
		Fonts on the Macintosh	255	May/June	13
		Fonts: An Overview	255	May/June	1
		Ihor's Unfamiliar Quotations (with apologies to Mr. Bartlett)	259	November/December	37
		New Font Alternatives	255	May/June	8
		PageMaker and Images	259	November/December	34
		Publish it Yourself!	259	November/December	32
		Seybold Conference 1989: A Report	259	November/December	23
Q/R	QuickMail	QuickMail for the Macintosh	252	January/February	4
	RAM	Does My PC Need More Memory for Running SAS?	253	March	20
		IBM Announces 486 Power Platform	257	September	17
		State of Even Faster Machines (The)	257	September	17
	References	Textbases and Resources for Humanities Computing	252	January/February	13
	Responsa Retrieval Project	Textbases and Resources for Humanities Computing	252	January/February	13
	Right Hand Man	Do You Need A Right Hand Man	255	May/June	34
S	Samsung	Laptops: Comparing Models	256	July/August	2
	SAS	Does My PC Need More Memory for Running SAS?	253	March	20
		Features of SAS/IML on a Microcomputer	254	April	32
		Introducing JMP: Exploratory Data Analysis on the Mac	259	November/December	7
		New SAS RLINK Files	252	January/February	21
		SAS News	259	November/December	17
		SAS on the SUN Workstation: An Update	257	September	22

CNews Index 1989

S

Keyword	*Article*	*Issue*	*Month*	*Page*
SAS	SAS under UNIX	254	April	31
	SAS/ETS Now Available for the PC	257	September	22
	SAS/FSP - What's in it for Me?	259	November/December	11
	SAS/PC License Renewal	255	May/June	26
	SAS/PC NEWS	254	April	30
Security	LOCKIT: Affordable PC Security	254	April	28
Services	35mm Slides for Macintosh Users	257	September	19
	FAX Service Now Available at UTCS!	257	September	18
	Information Centre Talk	256	July/August	10
	Microcomputer Courses	252	January/February	26
	Microcomputer Courses	258	October	20
	Microcomputer Short Courses	259	November/December	39
	Noncredit Short Courses	253	March	28
	PC Education Facility Upgrade	252	January/February	7
	ProComm Communications Seminar	252	January/February	6
	ProComm Communications Seminar	257	September	20
	Putting it Together. . . A Guide to UTCS	257	September	1
	UTCS Datapac Access to End	254	April	37
	UTCS Dial-In Facilities	254	April	37
SIAM	1989 SIAM Annual Meeting	257	September	28
Site Licenses	ARCHIVIST Now Available at UTCS	252	January/February	25
	Features of SAS/IML on a Microcomputer	254	April	32
	New SAS RLINK Files	252	January/February	21
	QuickMail for the Macintosh	252	January/February	4
	SAS News	259	November/December	17
	SAS on the SUN Workstation: An Update	257	September	22
	SAS under UNIX	254	April	31
	SAS/ETS Now Available for the PC	257	September	22
	SAS/PC License Renewal	255	May/June	26
	SAS/PC NEWS	254	April	30
	WATCOM C Version 7.0	256	July/August	15
	WATCOM License Renewal	255	May/June	26
	WATFOR-77 V3.1	258	October	6
Slidemaking	35mm Slides for Macintosh Users	257	September	19
Software	A Glimpse at Fontographer: Creating New Alternatives	255	May/June	18
	ARCHIVIST Now Available at UTCS	252	January/February	25
	Bitstream Fontware	255	May/June	9
	Checking Your Writing Electronically	252	January/February	16
	COREL DRAW	255	May/June	19
	CURVE™	258	October	2
	Do You Need A Right Hand Man	255	May/June	34
	Educational Discounts for Microcomputer Software	259	November/December	27
	Electronic Embryo (The)	252	January/February	19
	Features of SAS/IML on a Microcomputer	254	April	32
	Fonts and Microsoft Windows	255	May/June	10
	Fonts for WordPerfect 5.0	255	May/June	20
	Fonts on the Macintosh	255	May/June	13

CNews Index 1989

S

Keyword	Article	Issue	Month	Page
Software	Fonts: An Overview	255	May/June	1
	GAMS	258	October	1
	Good News, WordPerfect Users, WordPerfect 5.1 is Coming	259	November/December	28
	Graphics and WordPerfect	255	May/June	23
	Harvard Graphics Now at UTCS	254	April	29
	Image	256	July/August	6
	ImageStudio 1.5: Much More than MacPaint	256	July/August	8
	Introducing JMP: Exploratory Data Analysis on the Mac	259	November/December	7
	LOCKIT: Affordable PC Security	254	April	28
	MacWorld Products and Highlights	253	March	5
	MacWorld: Multimedia Computing	258	October	12
	Mathematica: A Review	254	April	35
	Mega CD-ROM: A Collection of Public Domain Software for the Macintosh	255	May/June	40
	Microsoft Word 4.0 for the Macintosh	259	November/December	30
	More Chaos on Your Computer	258	October	4
	New Font Alternatives	255	May/June	8
	New SAS RLINK Files	252	January/February	21
	NeXT	253	March	1
	Numerical and Scientific Software for Microcomputers	252	January/February	21
	Numerical and Scientific Software for Microcomputers	253	March	17
	Numerical and Scientific Software News	259	November/December	20
	Outline Applications on the Macintosh	255	May/June	37
	PageMaker and Images	259	November/December	34
	PICT Map Collection for the Macintosh	255	May/June	25
	Print View (View Document) in WordPerfect 5.0	258	October	10
	Printers Supported in WordPerfect 5.0	255	May/June	32
	QuickMail for the Macintosh	252	January/February	4
	SAS News	259	November/December	17
	SAS on the SUN Workstation: An Update	257	September	22
	SAS under UNIX	254	April	31
	SAS/ETS Now Available for the PC	257	September	22
	SAS/FSP - What's in it for Me?	259	November/December	11
	SAS/PC License Renewal	255	May/June	26
	SAS/PC NEWS	254	April	30
	Spreadsheets for Science and Engineering	259	November/December	14
	SPSS News	259	November/December	17
	SYGRAPH - SYSTAT's Graphics Bonus	253	March	12
	TACT - A Text Retrieval Program	252	January/February	8
	What Makes Microsoft Word 5.0 Better than Word 4.0?	258	October	7
	WordPerfect 5.0 for 4.2 Users	258	October	10
	WordPerfect 5.0 Update	253	March	29
	WordPerfect Company Changes Support	255	May/June	27
SOLVER-Q	Numerical and Scientific Software for Microcomputers	255	May/June	28
Speed	IBM Announces 486 Power Platform	257	September	17
	State of the 386's (The)	254	April	15
Spreadsheets	Can a Computer Add?	255	May/June	39
	Spreadsheets for Science and Engineering	259	November/December	14

CNews Index 1989

S

Keyword	Article	Issue	Month	Page
SPSS	Numerical and Scientific Software for Microcomputers	255	May/June	28
	SPSS News	259	November/December	17
Statistical Analysis	Features of SAS/IML on a Microcomputer	254	April	32
	Introducing JMP: Exploratory Data Analysis on the Mac	259	November/December	7
	New SAS RLINK Files	252	January/February	21
	SAS News	259	November/December	17
	SAS on the SUN Workstation: An Update	257	September	22
	SAS under UNIX	254	April	31
	SAS/ETS Now Available for the PC	257	September	22
	SAS/FSP - What's in it for Me?	259	November/December	11
	SAS/PC License Renewal	255	May/June	26
	SAS/PC NEWS	254	April	30
	SYGRAPH - SYSTAT's Graphics Bonus	253	March	12
SUN	Electronic Embryo (The)	252	January/February	19
SY-TOS	TLC Legacy 150 x^2 Tape Backup	255	May/June	33
SYGRAPH	SYGRAPH - SYSTAT's Graphics Bonus	253	March	12
SYSTAT	Numerical and Scientific Software for Microcomputers	255	May/June	28
	SYGRAPH - SYSTAT's Graphics Bonus	253	March	12
SYTRON	TLC Legacy 150 x^2 Tape Backup	255	May/June	33

T

Keyword	Article	Issue	Month	Page
TACT	Beyond Word-Processing - Searching and Analysing Text	252	January/February	11
TCP/IP	Computer Networks and TCP/IP	254	April	21
	Gateways from TCP/IP to other Network Protocols	254	April	23
	Let's Talk About It: External Networking Developments I	252	January/February	1
TELNET	Computer Networks	254	April	17
TempleGraph	Numerical and Scientific Software for Microcomputers	255	May/June	28
Tense Lectronix Corp	TLC Legacy 150 x^2 Tape Backup	255	May/June	33
TESTAT	Numerical and Scientific Software for Microcomputers	255	May/June	28
Text Analysis	Beyond Word-Processing - Searching and Analysing Text	252	January/February	11
	Dash (The)—More than Just a Straight Line	258	October	18
	Ihor's Unfamiliar Quotations (with apologies to Mr. Bartlett)	259	November/December	37
	TACT - A Text Retrieval Program	252	January/February	8
TLC	TLC Legacy 150 x^2 Tape Backup	255	May/June	33
Toshiba	Laptops: A Guide to Portable Computers	256	July/August	1
	Laptops: Comparing Models	256	July/August	2
	Laptops: Quick Points to Ponder Before Purchasing	256	July/August	5
TRENDS	Numerical and Scientific Software for Microcomputers	255	May/June	28
Typesetting	Fonts and Microsoft Windows	255	May/June	10
	Fonts on the Macintosh	255	May/June	13
	Fonts: An Overview	255	May/June	1
	New Font Alternatives	255	May/June	8

U

Keyword	Article	Issue	Month	Page
UNIX	Computer Networks	254	April	17
	GP UNIX Mail Change	255	May/June	25
	SAS under UNIX	254	April	31
UTCS	Excerpts from the 1989/90 UTCS Annual Plan	254	April	1
	Information Centre Talk	256	July/August	10
	Numerical and Scientific Software for Microcomputers	256	July/August	12
	Putting it Together. . . A Guide to UTCS	257	September	1

CNews Index 1989

U/V

Keyword	Article	Issue	Month	Page
UTCS	UTCS Dial-In Facilities	254	April	37
Virus	Virus Alert	252	January/February	7
VM	VM/SP Upgrade	257	September	21

W

Keyword	Article	Issue	Month	Page
WATCOM	WATCOM C Version 7.0	256	July/August	15
	WATCOM License Renewal	255	May/June	26
WATFOR	WATFOR-77 V3.1	258	October	6
Windows	Fonts and Microsoft Windows	255	May/June	10
Word Cruncher	Beyond Word-Processing - Searching and Analysing Text	252	January/February	11
Word Processing	Beyond Word-Processing - Searching and Analysing Text	252	January/February	11
	Checking Your Writing Electronically	252	January/February	16
	Dash(The)—More than Just a Straight Line	258	October	18
	Good News, WordPerfect Users, WordPerfect 5.1 is Coming	259	November/December	28
	Ihor's Unfamiliar Quotations (with apologies to Mr. Bartlett)	259	November/December	37
	Microsoft Word 4.0 for the Macintosh	259	November/December	30
	Print View (View Document) in WordPerfect 5.0	258	October	10
	Printers Supported in WordPerfect 5.0	255	May/June	32
	What Makes Microsoft Word 5.0 Better than Word 4.0?	258	October	7
	WordPerfect 5.0 for 4.2 Users	258	October	10
	WordPerfect 5.0 Update	253	March	29
	WordPerfect Company Changes Support	255	May/June	27
WordPerfect	Fonts for WordPerfect 5.0	255	May/June	20
	Good News, WordPerfect Users, WordPerfect 5.1 is Coming	259	November/December	28
	Graphics and WordPerfect	255	May/June	23
	Print View (View Document) in WordPerfect 5.0	258	October	10
	Printers Supported in WordPerfect 5.0	255	May/June	32
	WordPerfect 5.0 for 4.2 Users	258	October	10
	WordPerfect 5.0 Update	253	March	29
	WordPerfect Company Changes Support	255	May/June	27

Z

Keyword	Article	Issue	Month	Page
Zenith	Laptops: A Guide to Portable Computers	256	July/August	1
	Laptops: Comparing Models	256	July/August	2

UTCS *ComputerNews* Subscription Request Form

If you wish to have your name and/or address added, changed or deleted from our *ComputerNews* mailing list, please complete this form.

☐ **ADD**

☐ **CHANGE**

☐ **DELETE MY NAME AND ADDRESS.**

NAME, ADDRESS and POSTAL CODE, in full	PREVIOUS NAME and ADDRESS, in full (or include your old mailing label)

☐ Check here if you can receive *ComputerNews* by campus mail.

Comments on this issue of *ComputerNews*.

----------------FOLD HERE----------------

Return to:

ComputerNews
University of Toronto Computing Services
4 Bancroft Avenue, Room 217
Toronto, Ontario
M5S 1A1

UNIVERSITY OF TORONTO
COMPUTING SERVICES
TORONTO, CANADA
M5S 1A1